Pit and Quarry

With which is consolidated CEMENT-MILL & QUARRY

Member Audit Bureau of Circulations

Read in Largest Number of Plants

Published Biweekly on Wednesday for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime, and Other Non-Metallic Minerals.

Subscription price: $5 for 3 years, $2 for 1 year in the United States and possessions, North, Central and South America; elsewhere $1 additional for each year. Single copies 20c.

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Oregon Corporation Plans Cement Plant

FIRM TO SPEND $3,000,000

Construction of a $3,000,000 Portland-cement plant at Wallowa, Ore., with an ultimate capacity of 3,500 bbl. per day is planned by the newly-organized Wallowa Lime & Cement Co. of Portland, Ore. Dr. Eueidas K. Scott, 767 E. 27th St., Portland, is one of the incorporators of the company. Other members are Lewis H. Mills, Walter J. Burns, J. L. Webster, A. S. Kerry and R. Green. No definite announcement has been forthcoming as to when construction will begin or concerning the financing of the proposed plant.

To Install Classifiers and Thickeners at Mill

The Columbia Cement division of the Pittsburgh Plate Glass Co., Pittsburgh, Pa., is reported to be planning the installation of Dorr classifiers and thickeners for closed-circuit raw grinding at its cement plant at Zanesville, O.

Kansas City Plant Will Change to Wet Process

Changing of the Kansas City, Mo., plant of the Missouri Portland Cement Co., St. Louis, Mo., from the dry process to the wet process of manufacture is another development in the cement industry which is about to take place shortly, according to authoritative information.

Alpha Portland Cement Making Plant Additions

The Alpha Portland Cement Co., Easton, Pa., is completing the erection of a stock house and packing house under contract with the Burrell Engineering & Construction Co. at its Jamesville, Pa., plant. The stock house is of modern silo type with a capacity of 100,000 bbl. and was built to replace a smaller and less efficient building erected many years since. The packing house contains two new Bates packers which, supplemented by the one machine previously in use, will enable the company to eliminate overtime employment of labor during periods of peak shipments. In conformity with the tendency in the district the company is eliminating the old 25-cycle electrical equipment and installing new units designed for operation with 60-cycle current. In this connection an improvement of the power-factor characteristics of the plant is being effected by the installation of synchronous motors. This work is being performed by the company's own forces.

Two Cement Workers Die in Coal-Dust Explosion

An explosion of coal dust fatally burned two men in the plant of the Peerless Cement Corp., at Port Huron, Mich., last week. Elmer F. Rowe, 39, assistant superintendent, and Frank Young, 35, coal-mill operator, were the victims. Neither regained consciousness after the blast. Rowe and Young were inspecting the powdered coal room and opened a furnace door. The blast hurled the two men across the room.

Dolomite, Inc. Building New Plant at Detroit

Dolomite, Inc., is constructing a slag plant at Detroit, Mich., according to H. P. Eells, Jr., president. Construction is under the supervision of the Lake Ports Supply Co., while the design of the new plant was the work of Dolomite's engineering department, of which W. W. Pathoe is chief.

Scientists Study Effect of Mortar on Limestone

The Scientech Club of Indianapolis, Ind., recently gave a luncheon at Hotel Lockerbie at which Professor H. C. Peffer of Purdue discussed at length certain investigations being made at Purdue in an effort to assist Indiana oolitic limestone industries.

Considerable work is being done in an effort to determine the action of various mortars when used with Indiana limestone. The professor also touched on experiments which are being made in connection with ceramic tile.

Stone Boat Sinks in Lake Erie; 15 Drown

SURVIVOR TELLS OF DISASTER

The steamer *George J. Whelan,* loaded with limestone, sank in Lake Erie off Dunkirk, N. Y., on the morning of July 29 with a loss of 15 lives. Among those who went down with the ill-fated vessel were Capt. T. J. Wagge, of Cleveland, O. The ship was owned by the Kelley Island Lime & Transport Co., of Cleveland, O.

The *Whelan* was bound for Buffalo, N. Y., having sailed on the night before the disaster from Sandusky, O. The vessel's plight was discovered by another stone boat—the *Amasa Stone,* which brought six survivors into port at Erie, Pa., a few hours after the ship sank. Survivors testified that the ship overturned so suddenly that they were thrown clear of the deck and into the water.

Arthur Stamm, of Sandusky, O., was one of the crew who was rescued.

"There was nothing to do but swim for it," Stamm said. "I found myself in the water without a life preserver and, sensing the direction of the shore, started out. I must have swam for nearly a mile and my arms had hardly begun to tire when I sighted the lights of a ship.

"My cries were heard by the captain of the ship, which happened to be the *Amasa Stone.* It was short work picking me up, although it was very dark. I sure was glad to see that ship and will always be thankful to her captain."

The steamer *Whelan* once before had a disaster. It sank in the Detroit river on its maiden voyage in 1910, after a collision. Built in Toledo, the boat made its first trip under the name of the *Irwin L. Fischer.* It was raised and sold to an English firm which took it across the ocean, where it remained until after the war.

Indiana Crushed-Stone Plant Damaged by Fire

Fire caused considerable damage recently at the stone-crushing plant operated by Roy Vail near Kingston, Ind. The loss was partially covered by insurance, it is reported. The loss included several stone bins, an oil-burning engine, crusher, elevator, and several small structures.

Penn-Dixie Dedicates Trophy at Kingsport

HOLDS GENERAL CELEBRATION

The officials and employees of the Pennsylvania-Dixie Cement Corp., in its plant at Kingsport, Tenn., held a celebration, July 31, in dedicating the Portland Cement Association's trophy for no lost-time accidents during the year 1928. Although this ceremony had been considerably delayed, it nevertheless was accompanied by enthusiasm throughout its splendid program.

General Superintendent Felix Guenther, Jr., presided at the meeting and, at the proper time, delivered an appropriate address of acceptance. Serious discussions were interspersed with numbers by the Kingsport high-school band. The opening prayer and the benediction were pronounced by Rev. John W. Shuey.

W. H. Klein, general manager of the company, opened the program with an explanation of the occasion. He was followed by A. J. R. Curtis who, as representative of the Portland Cement Assn., delivered the presentation address. Veils were removed from the trophy by Misses Kiss and Trimble.

The main address of the occasion was then delivered by Blaine S. Smith, president of the Pennsylvania-Dixie Cement Corp. Other addresses and remarks were made by J. Fred Johnson, Mayor Charles Lingar, and Plant Superintendent R. A. Bechtold.

The safety committee at the Kingsport plant comprises, in addition to the general superintendent and the plant superintendent, the following employees: C. W. Kels, supt. of quarries; C. L. Bunn, office; M. L. Silcox, laboratory; Frank Wright, chief electrician; J. E. Trimble, master mechanic; John Henderson and E. M. Compton, shift foremen; T. L. Keith, repair foreman; E. R. Frey and Arthur Dickens, repairmen; T. C. Risk, head burner; John Kiss, yard foreman; Kyle Dishner, shops foreman; Frank Deck, carpenter foreman; Frank Todd, shale quarry foreman; C. S. Vance, baghouse foreman; and E. F. Smith, packhouse foreman.

Kentucky Sand Firm Uses Long Conveyor Hook-Up

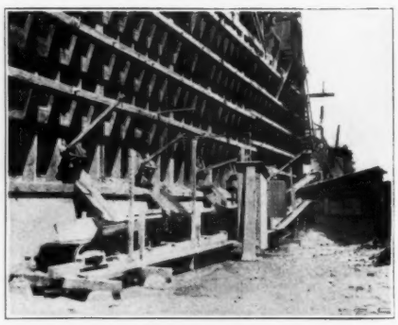
An unusual hook-up of long belt conveyors is found at the plant of the Nugent Sand Co., Louisville, Ky., this being new and one of the most complete sand distributing stations in the South.

Sand is dredged from the Ohio River, washed and loaded into barges which are towed to the plant. Here the sand is unloaded from the barges onto a 30-in. by 524-ft. conveyor, the lower terminal of which is built upon a movable platform in the water in order that it may rise and fall with the stage of the river. This conveyor is pivoted at its upper end where it discharges to another 30-in. conveyor which is on a considerable rise for a distance of 259 ft. At its discharge end is a hopper which, when opened, permits the loading of gondola railroad cars. If the sand is to be stored, it is discharged through this same hopper onto the third 30-in. conveyor which is 96 ft. long and is carried to the various bins. These storage bins are equipped with loading hoppers so that trucks can be driven underneath and loaded conveniently.

The conveyors were furnished by the Cincinnati Rubber Mfg. Co., Cincinnati, O.

Wisconsin Gravel Firm Reports Brisk Business

The Elkhart-Moraine Sand & Gravel Co., Elkhart Lake, Wis., has had a brisk business for the first part of the year, according to Lester Laun, sales manager. Three paving jobs were completed, one of which was the Kiel-



Belt conveyor for loading at Elkhart-Moraine plant.

Elkhart Lake 18-mile section of Highway No. 57. The company anticipates contracts for 15 miles of Highway No. 42 from Sheboygan Falls to Cedar Grove, and about 4 miles of Highway No. 141 from Sheboygan to Manitowoc. The present production of the plant is about 40 cars per day, which is about equal to 1929 records.

A new Bucyrus-Erie 41-B shovel and a new carloading belt conveyor have just been installed at the Elkhart-Moraine plant.

Premature Explosion Caused by Lightning

CEMENT WORKER MEETS DEATH

Lightning caused a premature explosion of 8 tons of dynamite recently at the plant of the Keystone Portland Cement Co., near Bath, Pa., and the instant death of George Sam, 35, chief blaster at the plant, who was blown to pieces.

The explosion happened on the north face of the quarry, adjoining the company plant. The dynamite charges had been placed in more than a score of holes, each drilled about 100 ft. deep and placed 20 ft. apart. It was the intention of the workmen to set off the blast as part of the inspection tour of a group of company officials from Philadelphia, who were expected during the afternoon.

During the height of the storm which swept over this section at about 4:30 o'clock Tuesday afternoon, Sam was seen to walk out to the edge of the quarry over the holes containing the charges. It is believed that he was inspecting the apparatus used for setting off the charge.

Suddenly a bolt of lightning and the roll of thunder rent the air and this was followed by a low rumbling sound of the dynamite charges detonating. As the various charges exploded, the terrific noise of the dynamite, intermingled with the noises of the storm, turned the vicinity of the cement plant into a bedlam.

Blasting operations at the Keystone plant are almost daily occurrences, but they are only small explosions. About every three or four weeks the process of quarrying requires exceptionally large blasting and the charges that had been prepared Tuesday were for this purpose.

The explosion caused no damage and injured no other person. It is the rule of the company that once a blasting charge has been drilled no person is allowed to enter the quarry hole proper or the immediate vicinity of the quarry. Sam, by virtue of his position as chief blaster, was able to ignore this ruling.

Belt conveyors at plant of Nugent Sand Co.

Plan to Buy Cement Direct Is Protested

ST. PAUL BUILDERS ACT

Protesting the proposal of the direct purchase of cement by the city from cement manufacturers, members of the Master Builders Association of St. Paul, Minn., recently sent a letter to Mayor Bundlie and the St. Paul city commissioners. A previous protest had been made by other builders.

In part the letter read:

"The purchase of cement by the city is a different problem from the purchase of that commodity by the state, as the state work on which cement is used is for highway paving only, and is delivered in carload quantities. On buildings, bridges and other state work the individual contractor makes his own purchases. Much of the city work is of many kinds and is carried on at different places in the city. Warehouses, trucking and other facilities would therefore be required in carrying out the proposed plan.

"Then, too, there are a number of firms in this city engaged in the business of selling cement. To make purchase direct from manufacturers would eliminate these firms from that business. All of them have a considerable investment in their business, maintain warehouses, trucking and other facilities for use in serving the public, and each of them has in its employ a number of people. All of which would necessarily be curtailed and affected under the proposed plan if carried into effect."

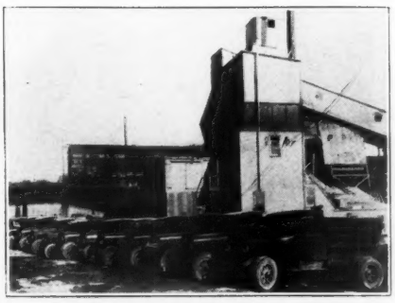
Select Port Inland as Name of New Plant Site

Port Inland is the official name of the site of the Inland Lime & Stone Co. dolomite plant now under construction 22 miles east of Manistique, Mich., on the shores of Lake Michigan. The war department has been advised of the choice of name which will be printed on all government maps in the future.

Ready-Mixed Concrete Delivered by 13 Trucks

That the Ready Mixed Concrete Corp. enjoys good business is obvious from the fact that it operates a fleet of thirteen delivery trucks. The company's plant, in Minneapolis, Minn., is situated on a short spur track whereon all materials such as sand, crushed rock, gravel and cement are received in carload lots.

Materials are fed to the two mixers directly by belt conveyors. When a mix is ready it is dumped into a waiting Reo truck equipped with a Wood Hydraulic Hoist & Body Co. bathtub body. The city of Minneapolis is zoned into eight districts and a flat price per cubic yard of mixed concrete is effective for particular mixtures and zones.



Fleet of concrete delivery trucks.

Dispatching is done from the mixing plant by a dispatcher who keeps in constant touch with all construction operations and who knows just how expeditiously drivers can handle their loads. The trucks are operated on an average of about 50 miles each per day, sometimes working 18-hour to 24-hour shifts. Drivers are paid a commission based upon the quantity of concrete hauled.

State Geologists Meet in Montana Aug. 24-29

The Association of American State Geologists, composed of chief geologists or heads of geology bureaus in 41 states, will hold its annual field conference in Montana, August 24 to 29. President Francis A. Thomson, of the Montana School of Mines, who is director of the state bureau of mines and geology, will be host to the association, and has planned a program that includes a six-day tour of the Montana Rockies, with visits to both Glacier and Yellowstone Parks, and a business meeting and banquet in Butte.

Work Is Progressing on New Texas Gravel Plant

Construction is under way on the new pit and gravel plant of Calloway & Fleming, near Eagle Lake, Tex. Workmen are busy laying a 2½-mile spur track from the main line of the Southern Pacific Ry. to the site of the operation. In addition to producing sand and gravel, the new concern will engage in the manufacture of concrete fence posts on a large scale.

Manufacturers' Group Will Meet at Chicago

TO PLAN CONVENTION EXHIBITS

The annual meeting of the Manufacturers' Division of the National Sand and Gravel Association will be held at the Stevens Hotel, Chicago, Ill., beginning with dinner at 6:00 p. m. on the evening of Thursday, September 18. The meeting will extend over until the following day, September 19, at which time plans will be considered with reference to the forthcoming exhibition at the fifteenth annual convention of the Association in St. Louis, Mo., at the Jefferson Hotel, on January 27, 28 and 29, 1931.

It is most important that every member company be represented at the annual meeting of the Division. Those attending will be afforded an opportunity to make suggestions with reference to the arrangements for the annual exhibit of machinery and equipment used in the sand and gravel industry. Officials of the National Sand and Gravel Association are anxious to conform in every way with the desires of the Manufacturers' Division, and they are disposed to cooperate with the Division in eliminating any causes for criticism which may have existed in the past. Under these circumstances it is quite essential that all members of the Division have a representative at the meeting.

Fire-Brick Maker Adds New Plant Locomotive

The A. P. Green Fire Brick Co. of Mexico, Mo., recently completed a program of extensive plant modernization costing approximately $2,000,000. The improvements include a new means of transporting materials from the pits to the plant, and a Brookville locomotive was purchased. This locomotive is powered by a McCormick-Deering engine. J. Harrison Brown, vice-president of the Green company, states that this machine hauls three 8-ton cars up a 2-per cent grade and believes that it could easily haul two to four additional cars per train.

Locomotive and cars at A. P. Green Fire Brick Co. plant.

Great Lakes Safety Trophy Is Dedicated

HUGE CROWDS SEE CEREMONY

About 900 persons attended the dedication of the Portland Cement Association's safety trophy by the Great Lakes Portland Cement Corporation at its plant near Buffalo, N. Y., on July 23.

Adam L. Beck, president, presided at the ceremony. The presentation of the trophy was made by A. J. R. Curtis, of the Portland Cement Association. The unveiling of the trophy was done by Misses Margaret Mary McHugh, Norma Weaver, Dorothy Then, and Betty Jane Taylor.

On behalf of his company, J. B. Zook, chief engineer, spoke in acceptance of the trophy.

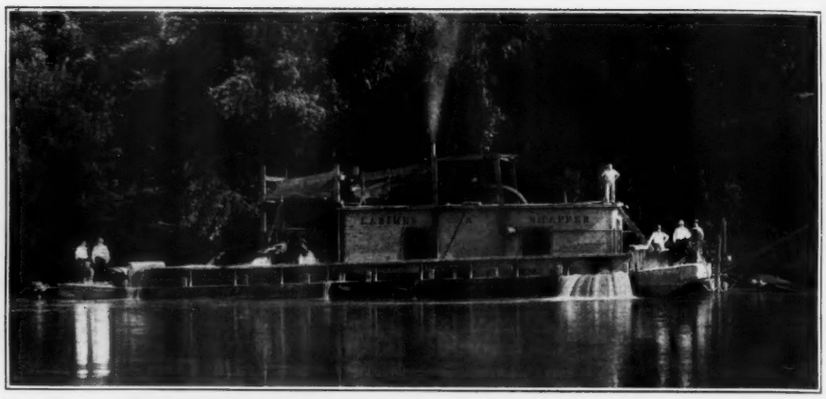
Addresses were made by Lt. Col. H. A. Reninger of the Lehigh Portland Cement Co., and by William J. Guilbert of the Buffalo Chamber of Commerce.

Immediately following this program, all guests were driven from the plant to the Commercial Street dock where a boat ride was provided to Crystal Beach Stadium. After an interesting series of amateur athletic contests, a picnic concluded the day.

Officials gathered about trophy after unveiling.

Topeka Sand Firm Sues Competitor for Damages

The Consumers Sand Co., of Topeka, Kan., has filed suit in the district court at Topeka against the Kansas Sand Co., asking $10,000 damages. The Consumers company charges that the defendant has infringed upon its lease on the north side of the Kansas River.



View of dredge which sank in Cedar River near Cedar Rapids, Ia.

Indianapolis Producer Reports Business Good

The State Sand and Gravel Co., operating one of the modern sand and gravel plants in Indianapolis, Ind., has many prospective orders for the summer months at the plant, according to James B. Spear, general manager of the company. The company has also been kept busy during the last few months with plentiful orders.

The plant is of all-steel construction and has a capacity of 600 cu. yd. of sand and gravel daily. In equipping its plant the State Sand and Gravel Co. installed the most modern equipment obtainable for production of sand and gravel. Five steel bins with a storage capacity of 70 cu. yd. each enable the company to maintain a large surplus of washed sand and gravel.

A 40-acre tract of land embraces the all-steel plant. The plant is estimated to have a supply of gravel which will last approximately 25 years, according to Mr. Spear.

Joliet Producers Soon to Build Crushing Plant

Markgraf & Lamb, Joliet, Ill., have leased 80 acres of stone deposits on the Robert Murray farm near Pontiac, Ill. Construction of a machine shop, rock-crushing plant, and storage bins will begin shortly. The company will produce road stone as well as agstone, and will deliver by truck to nearby Illinois points.

Dried-Out Seams Cause Dredge to Sink in Iowa

A sand and gravel dredge, owned by the Larimer & Shaffer Co., Cedar Rapids, Ia., and operated on the Cedar River, sank into the river on the night of July 25. The dredge is now lying on its side in 16 ft. of water, and in a very difficult position to raise. Mechanical equipment included a 10-in. Morris pump with a 125-hp. Kahlenberg marine engine.

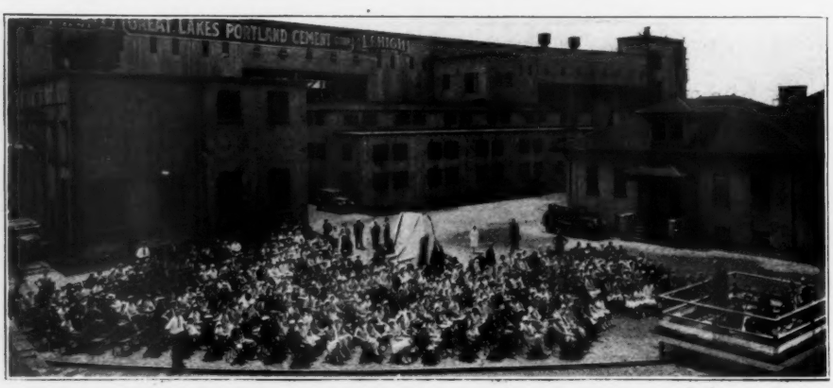
According to Mr. Shaffer, the accident was caused by the drying out of calked seams above the water line during the recent heat wave, causing the dredge to leak. On the day of its sinking, the dredge bore no evidence of leaks; however, early in the evening, boating parties noticed that it was listing badly. The dredge sank before the arrival of its crew. It was valued at $18,000.

Illinois Operator Opens Another Gravel Deposit

Rapid increase of business has required the opening of new pits and the addition of new equipment at the Iroquois Sand & Gravel Co., Clifton, Ill. The new pits are reported to produce a more superior grade of gravel than formerly obtained. A new ¾-cu. yd. crane has been purchased for the new plant, and four new Mack trucks have been added to the present fleet. D. M. Meents is president of the new company. W. H. Swival will be superintendent of the new plant.

Kentucky Sand Deposits Leased for 5-Year Term

The Bedford Nugent Sand & Gravel Co., Hawesville, Ky., has leased sand and gravel deposits adjacent to the county line on the Ohio River for a period of five years at an annual fee of $500 per year. The company may renew its contract for another term of five years upon the expiration of the present contract if desired. At the same time an agreement was reached whereby the company is to pay $2,000 for sand and gravel taken from the river during past years.



Crowd at Great Lakes Portland Cement Corp. safety-trophy dedication.

View of plant from west with track from quarry and crusher house in foreground.

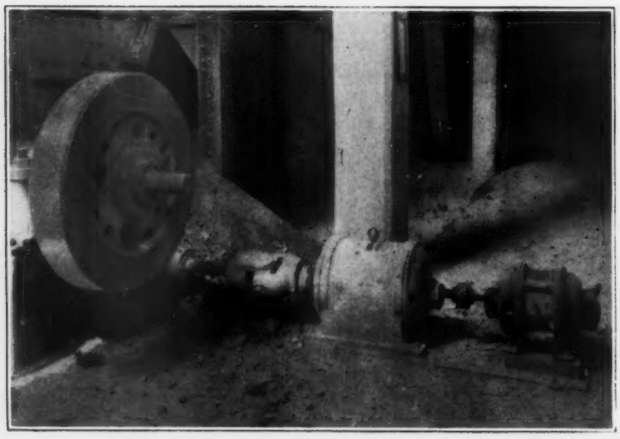
Plant of Republic Portland Cement Co. in Second Year of Production

Large Raw-Material Capacity and Close Chemical Control Feature Operations

A YEAR of successful and trouble-free operation has proved that the plant of the Republic Portland Cement Co. is what was claimed for it when it went into operation: a modern, well-designed and well-built plant. Outside of a few very minor changes this plant is now exactly as it was in August, 1929, when the first cement was shipped. It is a wet-process plant with a rated capacity of 3,600 bbl. per day, although it has produced as high as 3,900 bbl.

There are a number of features about this plant that make it of more than usual interest. These include: the natural advantages of the plant site; the easy availability and single reduction of the raw

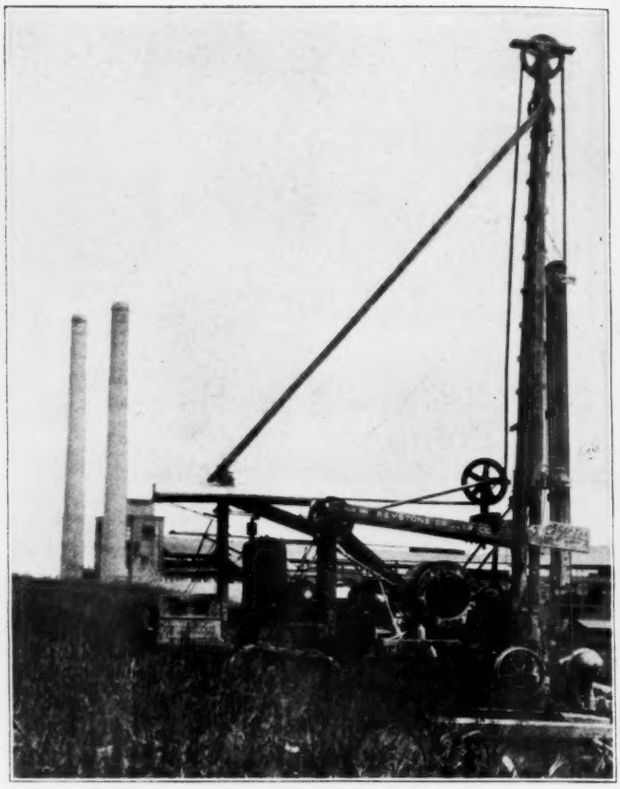
Aerial view of village of Longhorn and plant of Republic Portland Cement Co. Quarry in left background.



Speed-reducer drive of movable hammermill breaker plate.

material; the unusual amount of concrete above foundations in the plant construction; the ample raw material handling capacity; the close chemical control; and the unusual design of the cement storage silos. In keeping with modern practice this plant can be enlarged at a minimum of expense and without interference to production. These features are described in greater detail in the following pages.

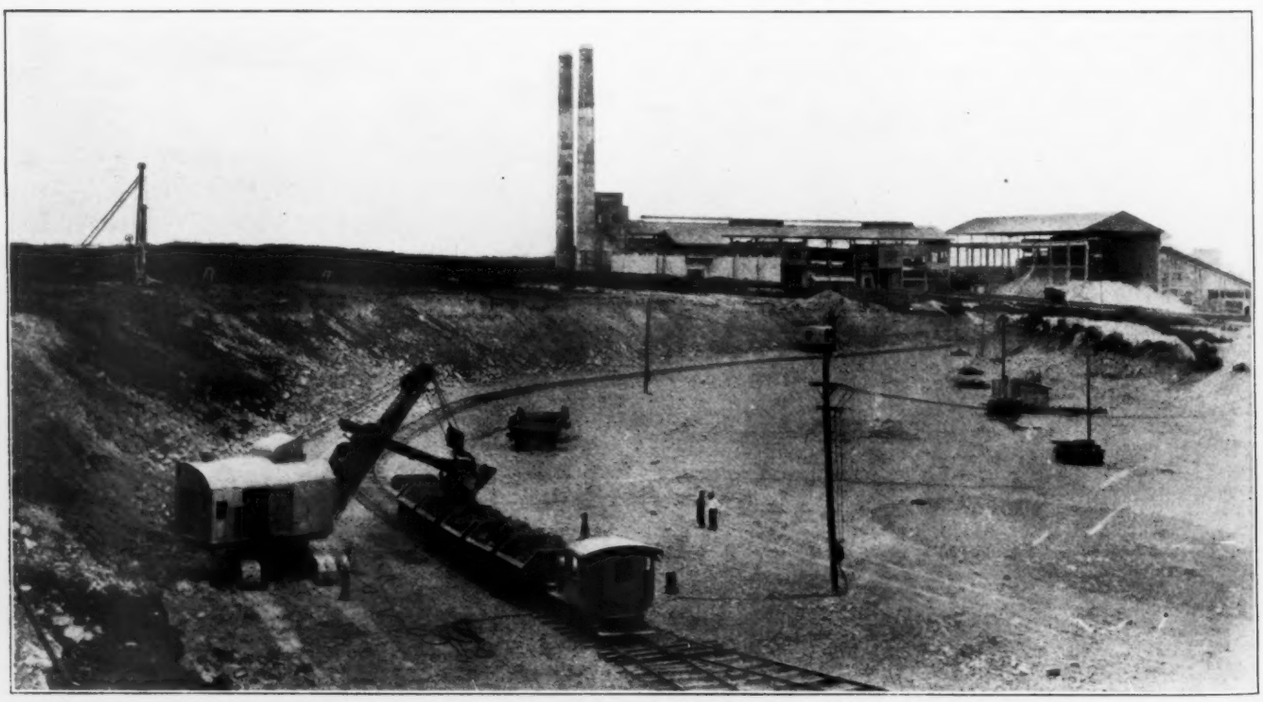
The plant and quarry are on a 475-acre property located about 8 miles northeast of San Antonio. Many things were considered before this property was selected. The main considerations of course were a good deposit of raw material and accessibility to economical transportation. Another was the gently sloping deposit which would permit the development of a good face without the necessity of pumping for drainage. The mill is located on low land at the south side of the property and quarrying



The gasoline-driven well drill at work. Plant in background.

operations extend northward into the hill which rises to a height of 126 ft.

The location is close enough to San Antonio to get a good switching rate and yet far enough away to be safe from residential developments for many years to come. The plant is near the San Antonio-Austin Highway and is connected with the main



View from end of quarry toward plant. Shovel loading high cement rock in foreground, well drill at left, low cement shovel in background.

Interior of raw-material and clinker storage with raw and finish mill feed bins and mill building at right. Note the unusual amount of concrete construction.

lines of the Missouri, Kansas & Texas, and the Missouri Pacific Rys. The former runs alongside the property, while the other is connected by a 3-mile switchtrack.

The plant was built primarily to serve the city of San Antonio with its great annual construction program and the Rio Grande Valley of Texas for which that city is the natural and geographic source of supply. This section of Texas is growing rapidly and is becoming an important part of the economic structure of the state. Government construction programs also call for the expenditure of many millions of dollars each year in this territory.

The raw material on the property comes from the upper and middle zones of the Austin chalk formation which was formed during the Upper Cretaceous period. It is a soft argillaceous limestone varying from soft earthy to fully solidified material and with a calcium-carbonate content running from 30 to 92 per cent. A large volume opposite the center of the face, however, is natural cement rock carrying, within 2 per cent, the correct proportions of clay and limestone for making cement. This constitutes about 80 per cent of the deposit. The problem of securing the proper raw mix at this plant is reduced to the comparatively simple operation of correcting

The inclined conveyor from the crusher building to raw storage. The movable tripper is at the right.

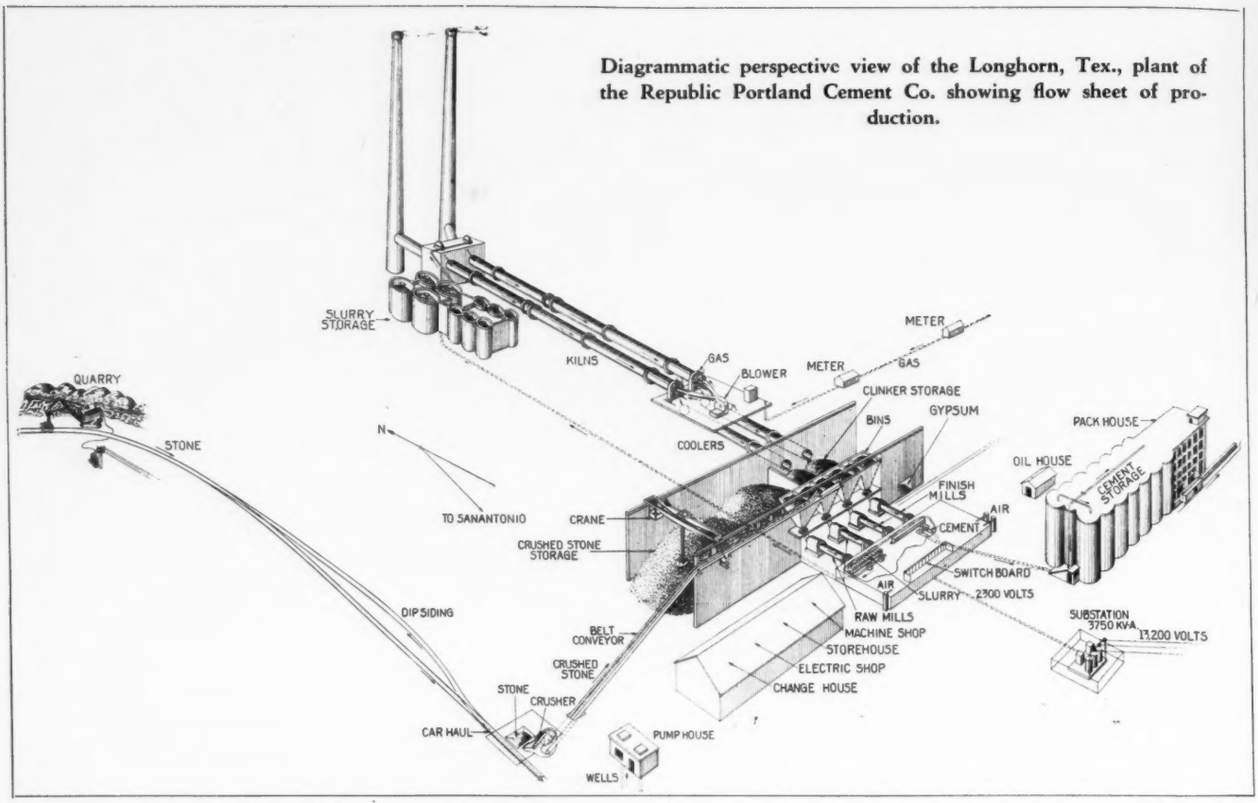
The electric shovel loading rock to cars in quarry.

the raw material by slight admixtures of materials higher or lower in lime content.

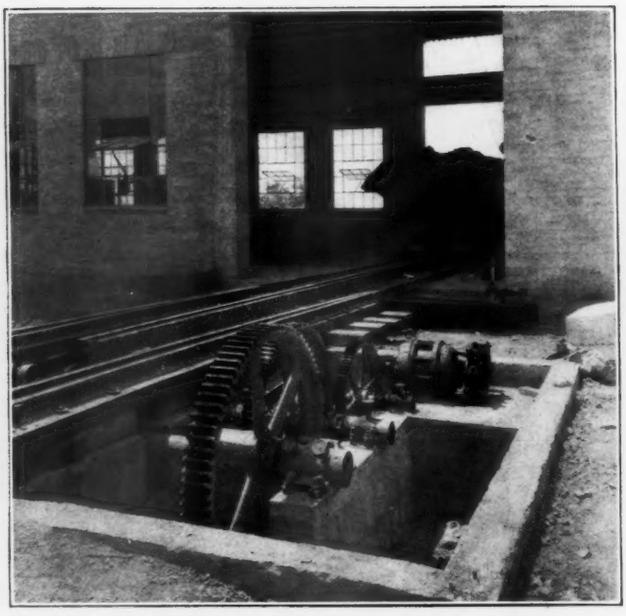
The far end of the quarry is high-lime rock, while the near or shallow end with its overburden of clay has a low-lime content. It has been found advisable in actual operation to keep the calcium-carbonate content low and to bring it up by adding high limestone. The deposit has been thoroughly tested so that the exact composition of the material in various parts of the deposit is known. Raw material to make 75,000,000 bbl. of cement has been blocked out.

The quarry was opened parallel to a dip in the deposit and to a ravine which was lowered to give an initial face of 25 ft. with natural drainage of the quarry floor. The face has been worked in a semi-circle to the north of the original cut which has resulted in a gradually increasing height of face. The quarry now has a face 700 ft. long and from 30 to 50 ft. in height. The quarry can be operated for many years before artificial drainage will be necessary.

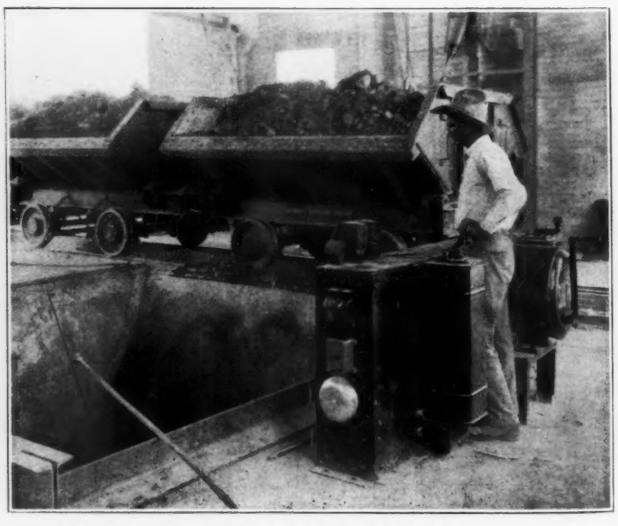
There is very little overburden, varying from 0 to 3 ft. in depth. Most of the drilling is done with a Keystone "Joplin Special" well drill driven by a Waukesha gasoline motor and mounted on crawler



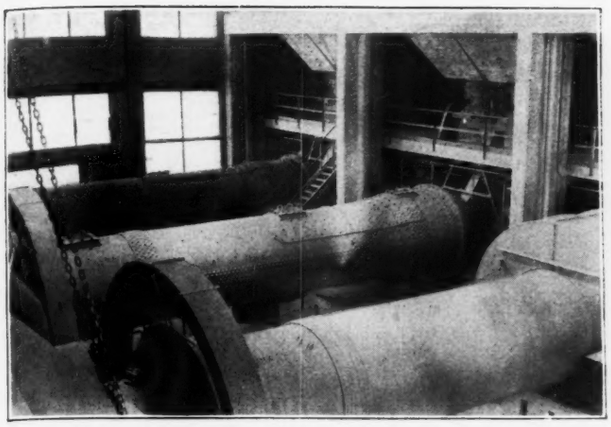
Diagrammatic perspective view of the Longhorn, Tex., plant of the Republic Portland Cement Co. showing flow sheet of production.



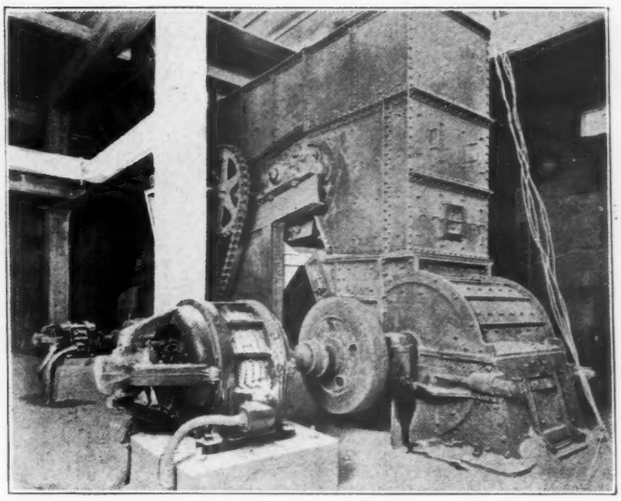
The car puller which spots cars of stone to be dumped into the crusher hopper.



Cars of rock ready to be dumped into crusher hopper. Controls at right, hoist in background.



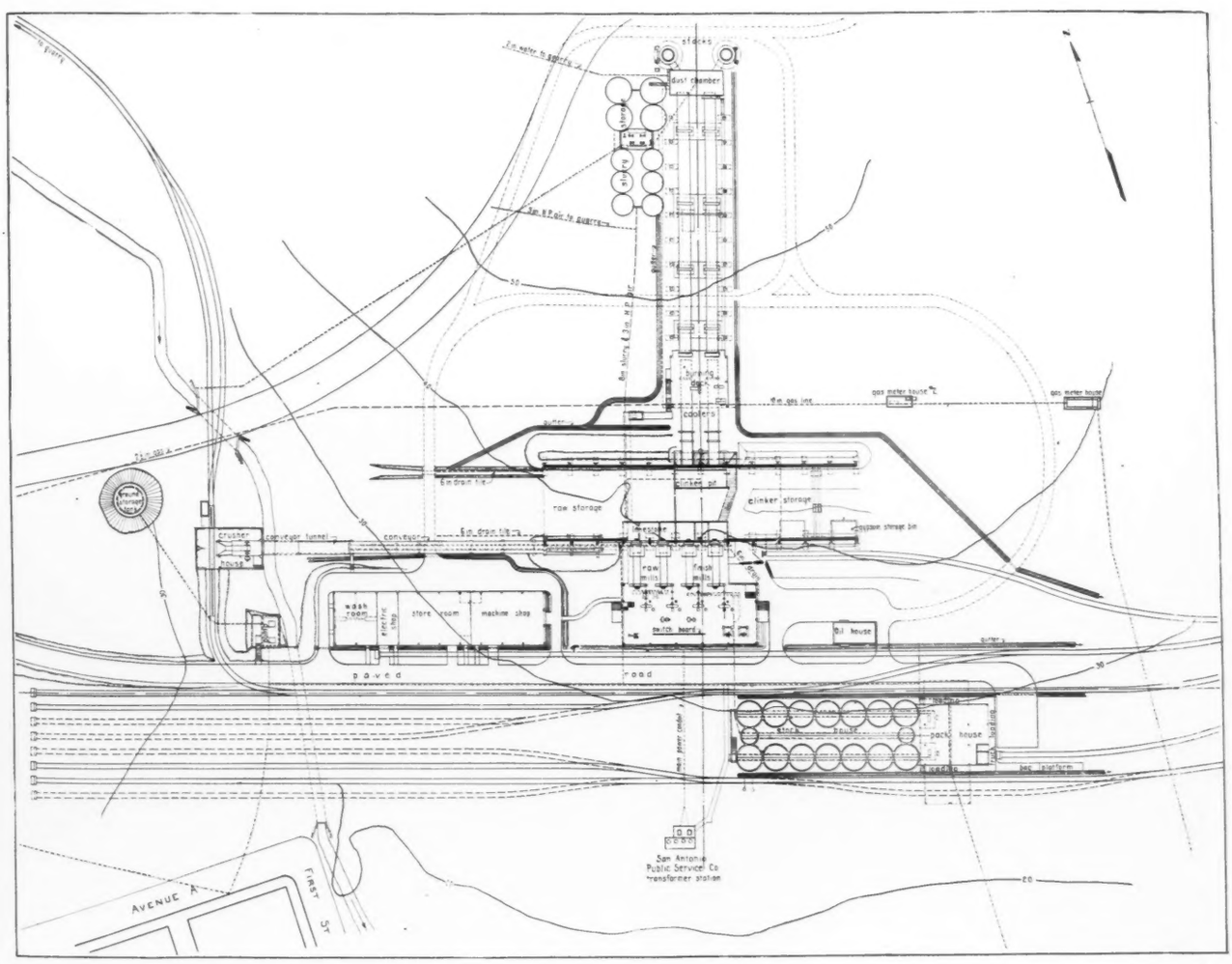
View of mill room showing feeders to raw mills at left.



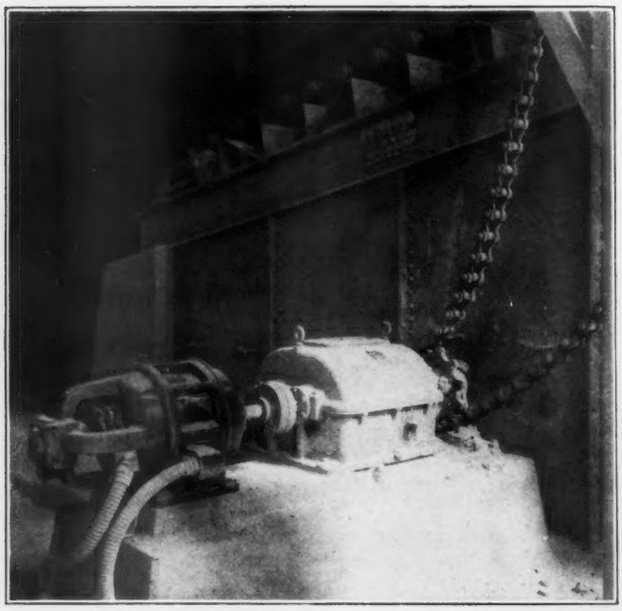
The hammermill crusher which reduces raw material in one operation.

treads. An Ingersoll-Rand wagon-mounted drifter drill is also used for faces up to 30 ft. Holes are drilled on an average 3 ft. below the level of the quarry floor. As the elevation of every hole is marked, this can be accurately done. Atlas 40-per cent dynamite is used and averages from 5½ to 6 tons of stone per pound. What little secondary drilling is necessary is done with Ingersoll-Rand jackhamers.

Loading of stone is being done by a Marion Type 480, 2-cu. yd. electric shovel mounted on crawlers. Material for correcting the mix is loaded by a 1-cu. yd. gasoline crawler shovel. These load into trains of six Easton steel side-dump cars of 8-cu. yd. ca-



Plan drawing showing layout of plant of Republic Portland Cement Co. at Longhorn, Texas. The ease with which additional units to increase capacity can be installed is apparent.



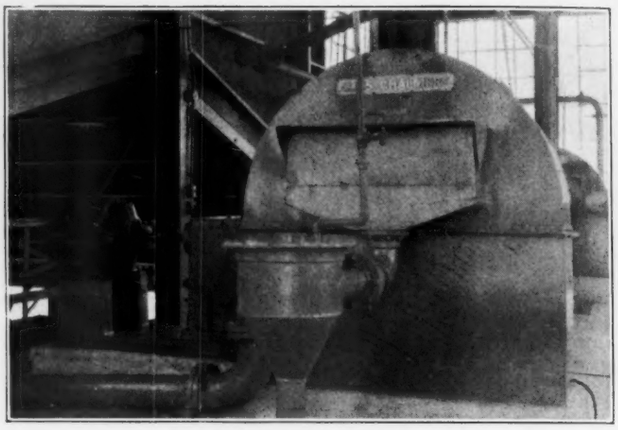
Speed reducer and chain drive of feeder which conveys rock from hopper to hammermill.

pacity each which are hauled to the plant by a Plymouth 14-ton gasoline locomotive. The quarry is served by a single standard-gauge track about 1,000 ft. long from the crusher house. As the quarry floor is at practically the same elevation as the crusher house the raw material hauling cost is unusually low.

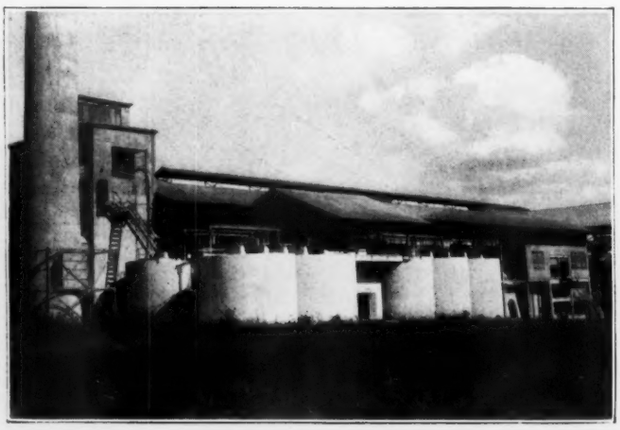
Raw Crushing and Storage

The locomotive pushes the loaded train through the crusher house and takes an empty train from a dip siding alongside the building. The loaded cars are then spotted successively alongside the crusher hopper by a Link-Belt endless chain and lug car puller. This also clears the empty train into a dip siding without assistance from the locomotive.

A Shepard overhead hoist, powered by a 20-hp. motor, dumps the cars by means of a self-attaching, self-clearing, counter-balanced bracket arm and hook. The controls for all of the crusher house machinery are on a platform alongside the hopper from which one man controls all of the machinery. The hopper discharges to a Stephens-Adamson pan feeder which feeds the Dixie Machinery Co. Mogul 50-in. by 50-in. hammer mill. The feeder is driven by a 15-hp. variable-speed motor through a James speed reducer so that the rate of feed can be adjusted to the crusher load. The crusher is driven by a 250-hp., 2,200-volt motor and has a movable breaker plate, adjusted by a 5-hp. motor, which prevents clogging when the material is wet and sticky or high in clay content.



The two Ferris-wheel kiln feeders with speed-reducer drive at left.



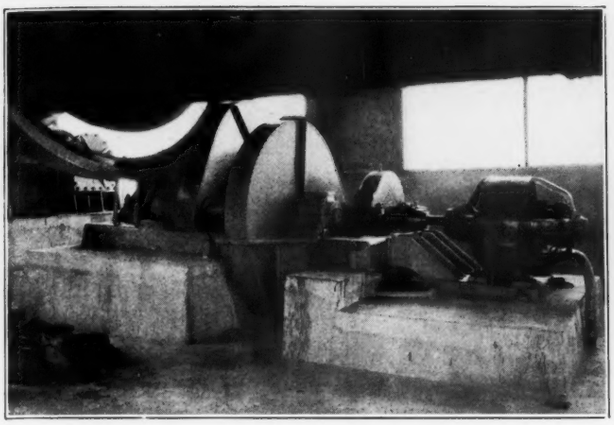
View from northwest showing slurry-correcting and storage tanks.

The overhead crane spanning the storage discharging clinker to finish-mill feed bin.

The crusher is set in a deep concrete pit excavated in solid rock. The crusher discharge and spillage from the feeder are delivered by a series of hoppers to a 36-in. belt conveyor on 400-ft. centers which rises on an incline of 16 deg. This runs first through a concrete tunnel, then on a reinforced-concrete trestle to the end of the storage structure where it levels out for 125 ft. to allow discharge.

The stone is dumped from the conveyor into either of two spouts by a movable tripper or by dust-screened hoppers directly into the feed bins. The mechanical parts of the conveyor and the tripper were furnished by the Link-Belt Co., and the conveyor belting by the Hewitt Gutta Percha Rubber Corp. The conveyor is driven by a 40-hp. motor through a speed reducer and chain and sprocket drive.

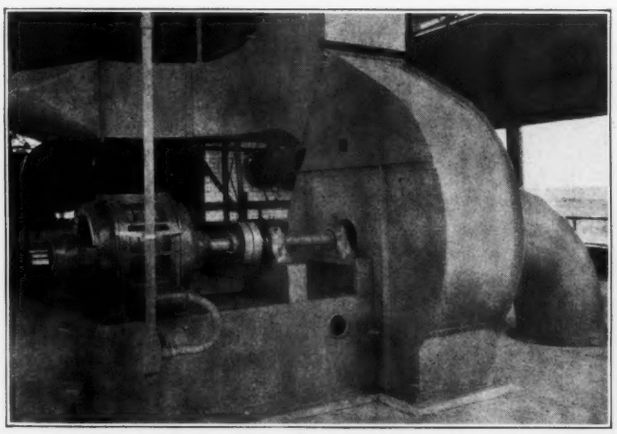
All parts of the quarry, transportation, feeding, and crusher equipment are capable of handling rock as large as 2-cu. yd. in size. The crusher will reduce



The quadruple-reduction-gear kiln drive.

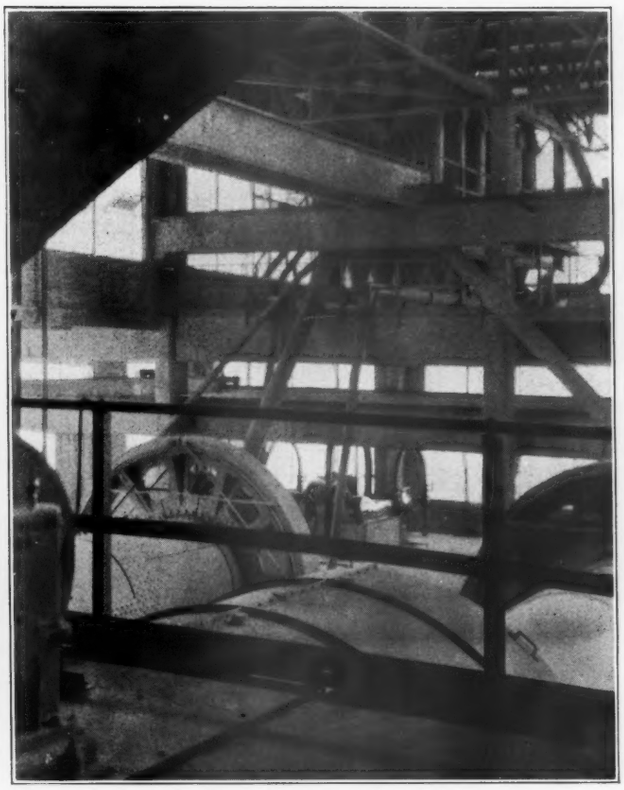
rock of this size to ¾-in. and under in one operation. All of this equipment also has ample capacity to take care of any future increase in production. Ten hours' operation of the quarry and crusher supplies enough raw material for 24 hours of plant operation.

The outside storage structure for rock, clinker,



The centrifugal fan which furnishes air for the kiln gas burners.

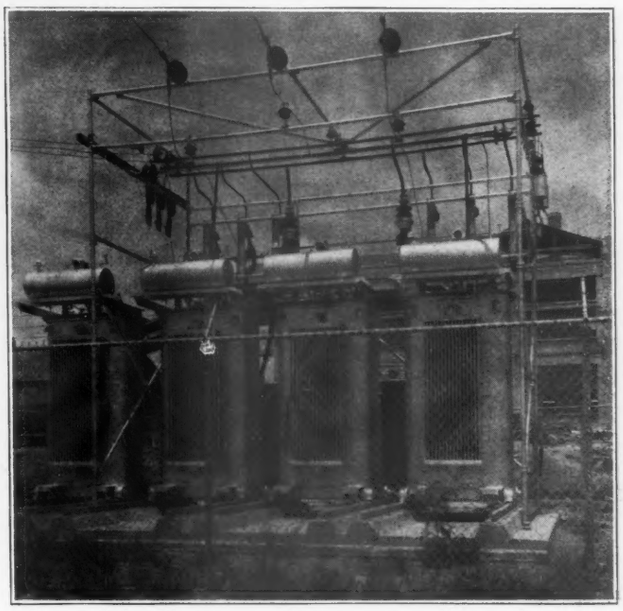
and gypsum is 300 ft. long by 70 ft. wide center to center of the crane beams supporting the overhead crane which spans the structure. The storage is divided into five bays for raw material storage and seven bays for clinker and gypsum. It has a capacity of 6,000 tons of rock, 50,000 bbl. of clinker, and 350 tons of gypsum. A Pawling and Harnischfeger 7½-ton crane handling a Williams 3-cu. yd. clamshell bucket handles all materials to and from storage. Paved earth fills instead of the usual verti-



View from mill-feeder floor showing finish mills, compressors and dust collector.

cal concrete walls serve to retain the materials.

Contrary to customary practice and in accordance with the policy of the plant to use concrete wherever possible and practical, the entire structure up to the crane runway is of reinforced-concrete construction. The columns are of the self-supporting buttress type and are connected at the top by the concrete crane beams and at mid-height by concrete struts. The concrete crane beams are continuous



The transformer substation which reduces to 2,300 volts for the plant.

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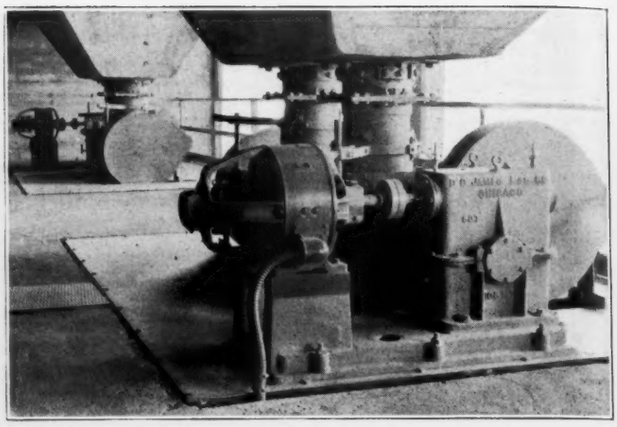
The fans for the dust collector in the mill building.

except for an expansion joint at a split column in the center of one side and at sliding supports at intersections with the bins on the other side. All of the raw storage and half of the clinker storage has a steel-truss roof supported on steel columns resting on the concrete.

The six mill feed bins for stone, clinker, and gypsum are within and along one side of the storage, centering on the division wall. They are of concrete with hopper bottoms and one fully sloped side and have a total capacity of 1,370 tons. They are in two groups of three bins each, two for high and one



The table feeders which feed clinker and gypsum to the finish-grinding mills.

for low limestone, and two for clinker and one for gypsum. This arrangement is unusual in that each of the two raw grinding mills has its own high lime hopper and each of the finish mills has its own clinker hopper. The single low lime and gypsum hoppers are of the forked type, each feeding two mills.

Raw Grinding and Slurry Mixing

The mill building houses both the raw and finish grinding mills and the power house as well. High and low limestone are fed from their bins by two pairs of Allis-Chalmers 72-in. table feeders to the two Allis-Chalmers 7-ft. by 8-ft. by 40-ft. raw grinding Compeb mills. Each pair of feeders is driven by a 5-hp. d.c. motor through a James spur gear speed reducer. The rates of feed have three adjustments—the speed of the motor, the vertical feed opening, and the position of the scraper blade.

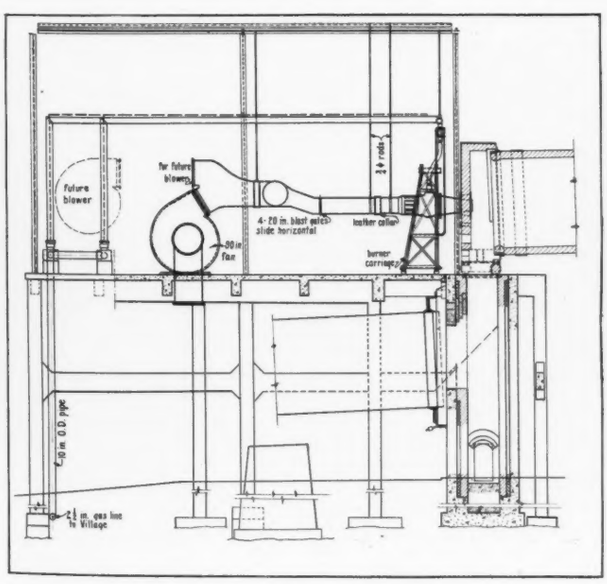
Interior of mill building with mills and motors at left; motor generator, compressors and main switchboard at right. Dust collector above.

The main switchboard in the mill building. The power demand limitator is in the center of the end panel at the right.

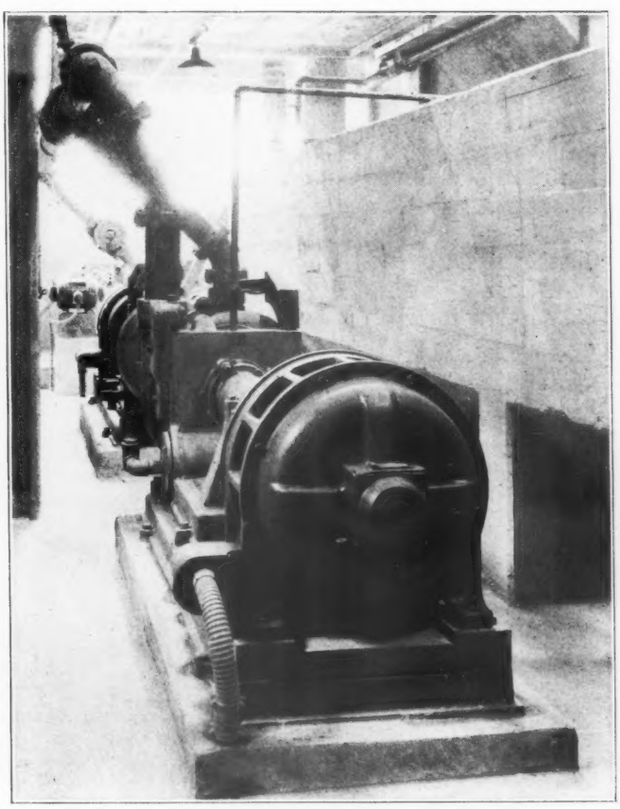
Each of the Compeb mills is driven by an 800-hp. 2,200-volt super-synchronous motor through a single spur-gear reduction. These mills were originally equipped with pickup pipes, similar to the finish mills, but because of the gummy nature of the material it was found advisable to convert them into straight-line mills. This was done at slight expense and no difficulty has been experienced in getting excellent capacity and fineness from them.

The slurry is ground to a fineness of 90 to 95 per cent through a 200-mesh sieve. It is discharged from the mills into a horizontal receiving sump where the slurry is agitated by a double-ribbon conveyor. The slurry, which has the unusually high water content of 42 per cent, is handled by two 6-in. Wilfley pumps to the slurry tanks. As these are located on the opposite side of the storage from the mill building, the 10-in. slurry line runs through a tunnel under the storage to the tanks. This tunnel also houses the air, water, and electric lines and offers a short cut for chemists or others going from one side of the storage to the other.

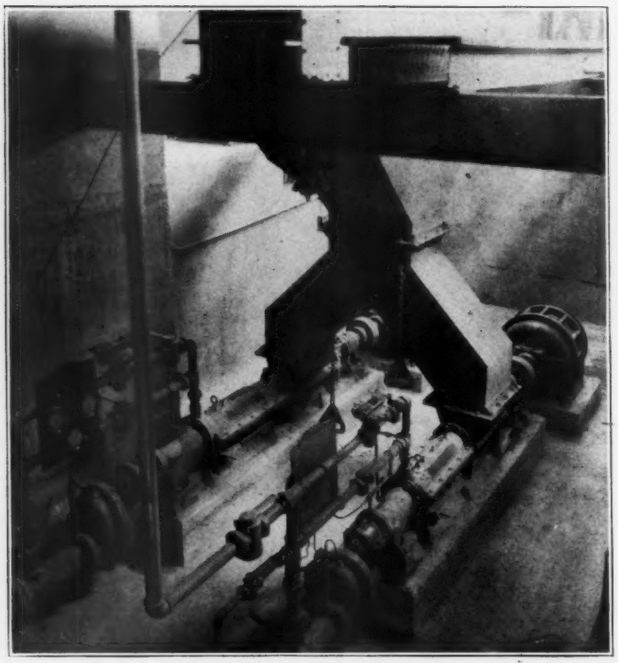
There are six concrete slurry blending tanks each 20 ft. in diameter and 30 ft. high, and four correcting tanks 24 ft. in diameter and of the same height, located near the feed end of the kiln. These hold



Cross section of kiln burning floor showing arrangement for gas burning. Cooler below.



The centrifugal slurry pumps which feed from raw mills to storage.



The two pneumatic pumps which convey cement from finish mills to the silos.

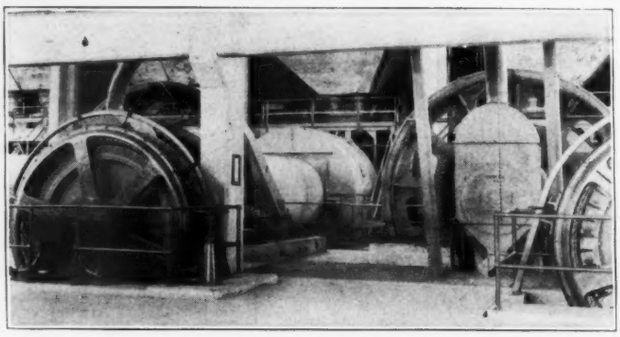
about 48 hours' supply of slurry. The blending tanks are arranged in two rows of three and discharge to a concrete sump. Two 6-in. Wilfley pumps feed the correcting tanks. These also discharge to a sump from which two 4-in. Wilfley pumps handle to the slurry feeder. Merco-Nordstrom lubricated plug valves are used on all slurry suction and discharge lines. The 6-in. pumps are driven by 75-hp. motors and the 4-in. pumps by 40-hp. motors. The two sumps and the slurry pumps are in one concrete pit about which the tanks are arranged. The two sumps have ribbon agitators.

The tanks have an operating deck, level with their tops, on which are the control valves and the electric control panels. Each tank is equipped with a Meade mechanical and air agitator. Each row of three blending tanks and each pair of correcting tanks is driven by a 25-hp. motor through a James herringbone speed reducer. The motors and their controls are at the center of the platform over the pump pit and are covered with a roof for protection.

The discharge lines of the 6-in. and 4-in. slurry pumps are so interconnected that they make possible a variety of combinations for slurry blending. The chemist samples the slurry in each of the blending tanks as it is being filled and computes the amount of correcting slurry to be drawn with it. The slurry is then drawn from the two tanks in the proper proportions and transferred to one of the correcting tanks. Here it is again checked and further corrected if this is necessary. It has been found possible in ordinary practice to regulate the desired proportions within 0.15 per cent.

Kilns and Coolers

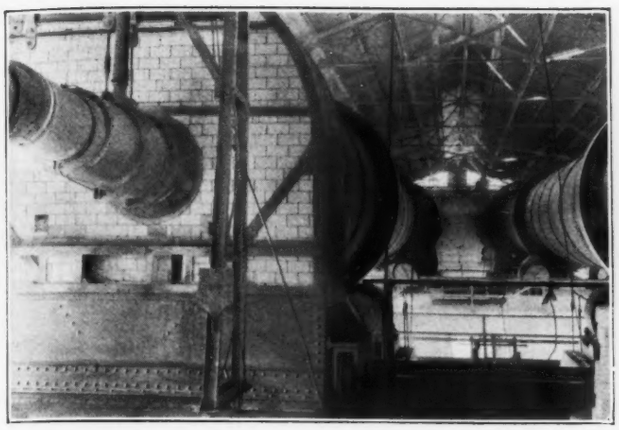
The two Allis-Chalmers kilns are each 11 ft. in diameter by 250 ft. long, and are lined full length. Each kiln has four tires on two-roller supports, and



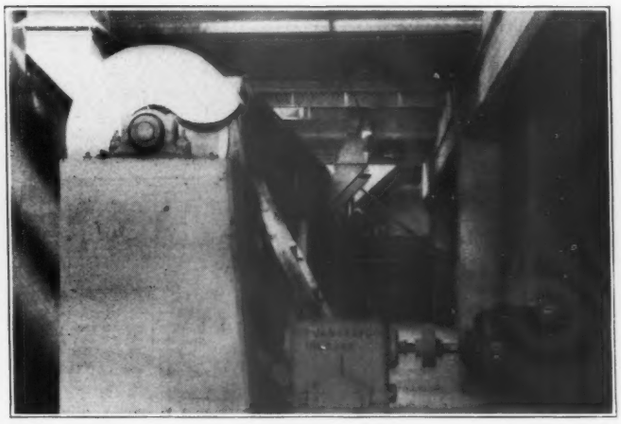
The two finish-grinding mills with their 800-hp. supersynchronous motors.

a driving ring, and is driven through quadruple reduction gearing by a 75-hp. variable-speed d.c. motor. This drives the kiln at any speed between ½ and 1 r.p.m. The kilns are mounted on an incline of ⅜ in. per ft. and are fired with natural gas at 1½-lb. pressure by single Tate-Jones burners. These are equipped with Leeds-Northrop temperature recorders. Two burners were previously used for each kiln, using gas at 8-oz. pressure but it was found more economical and efficient to use gas and air at a higher pressure. A hot-air blast is furnished from the coolers by a 90-in. Buffalo fan, driven by a direct-connected 100-hp. motor, pre-

Plant of the Republic Portland Cement Co. from the east. Packhouse and cement storage silos at left.



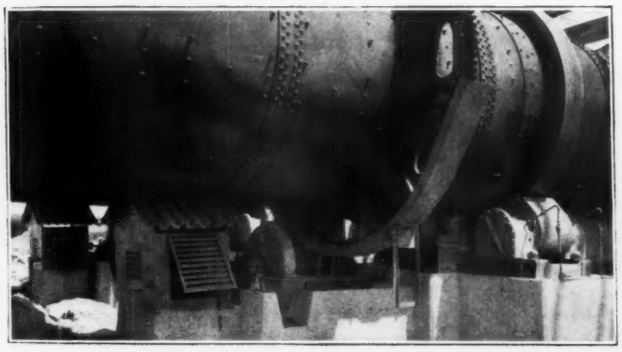
Discharge end of one of kilns showing single gas burner.



The speed-reducer drive of the screw conveyor feeding cement from finish mills to pneumatic pumps.

heating the air for combustion and at the same time cooling the clinker in the coolers.

Slurry is fed to the kilns by two Allis-Chalmers ferris-wheel feeders which are driven by 5-hp. d.c. motors through James speed reducers. The feed end of the kiln projects into a firebrick lined hopper-bottom concrete dust chamber which connects by steel breeching with the two 200-ft. reinforced concrete kiln stacks. The dust chamber carries the kiln-feed deck. On the burning deck, in addition to the blowers and kiln hoods, are located the electric control panels and the gas meters. The burner can control all operations of the kilns and feeders without moving from his post. Provision has also



The clinker cooler drives with motors enclosed in ventilated housings.

been made to use oil burners in case of a gas shortage. Due to the nature of the raw material, considerable trouble was at first experienced with clinker rings. This has been reduced considerably by a constant uniform feed and by regular shooting before the rings became too large, using Remington kiln guns.

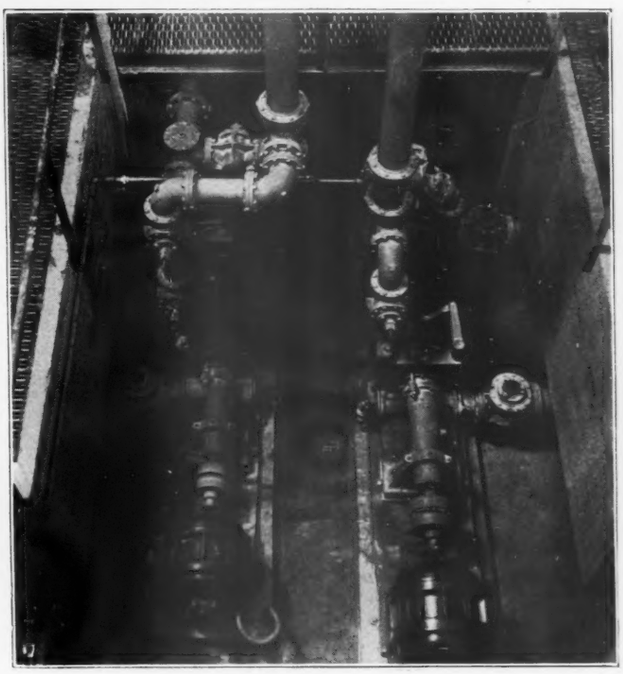
The clinker at a temperature of 2,000 deg. F., falls from the ends of the kilns into small lined pits which discharge through short chutes into the coolers. The two 10-ft. by 100-ft. Allis-Chalmers coolers are lined for the first 30 ft. with firebrick, then with cast iron lugs for 30 ft., and are unlined for the remaining 40 ft. Each cooler is driven by a 50-hp. motor at the rate of 1½ r.p.m. They extend under and beyond the burning deck and discharge through openings in the storage space wall to the clinker storage pit where the clinker is rehandled by the overhead crane.

Finish Grinding

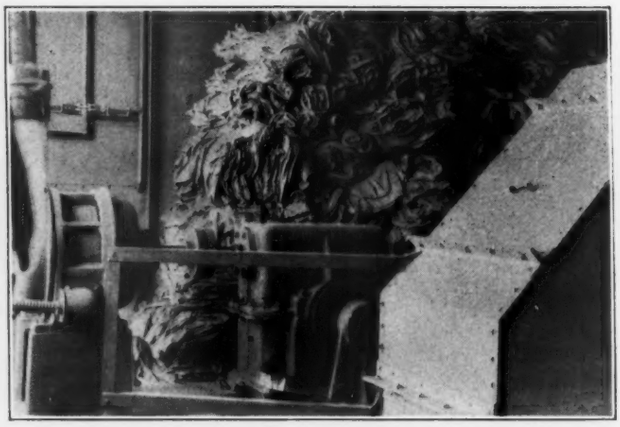
The crane delivers the clinker either from storage or directly from the coolers to the two finish mill feed bins previously described. Two pairs of Allis-Chalmers table feeders discharge the clinker and gypsum to the two Allis-Chalmers 7-ft. by 8-ft. by 40-ft. finish-grinding Compeb mills which are of the scoop-feed type. Coates forged steel balls are used in all of the mills. The compartments in the finish mills have 2½-in. to 5-in. balls, ⅞-in. by 1¼-in. slugs, and ⅝-in. by ¾-in. slugs, respectively. The raw mills have 2½-in. to 5-in., ⅞-in., and ⅝-in. balls.

A 12-tank Northern Blower Co. dust-collecting system on a mezzanine floor in the mill building acts as a ventilator as well as a dust collector for the mills. Two 20-hp. motors drive the blowers for this unit.

The finish mills discharge to a screw conveyor



Some of the slurry pumps viewed from above.



Screw conveyor drive of cement elevator in packhouse. Dust collector behind piled sacks.

which delivers the finished cement, together with the returned fine cement from the dust collectors, to either of two 6-in. Fuller-Kinyon pumps in a pit in the basement of the mill building. These discharge through a 5-in. line to the top of the storage silos where the cement is distributed to the various bins by means of a system of pipes and valves.

Cement Storage and Packing

The concrete cement storage structure has a total capacity of 153,000 bbl. and is an original design. It consists of two rows of seven silos, 24 ft. in diameter and 75 ft. high, with a clear space of 16 ft. between them. This forms a large central bin of 46,000-bbl. capacity closed at each end by a small end bin. This design is claimed to give a greater storage capacity at a smaller initial cost. The silos are on a massive, heavily-reinforced concrete slab resting on clay.

The silos have sloping bottoms that are self-cleaning and discharge to three tunnels underneath, each with a 14-in. screw conveyor running its full length. The three screws discharge by gravity to two bucket elevators on 80-ft. centers. A reversible cross screw conveyor can feed from either side screw to the opposite elevator and a flop gate allows the center screw to discharge to either elevator. This feature gives great flexibility of feed and insures against any delay due to a breakdown of one of the elevators. Each tunnel conveyor is driven by a 40-hp. motor through a James speed reducer.

The packhouse is a four-story structure adjacent to the cement storage. The two elevators previously mentioned discharge to two reversible cross screw conveyors and screens on the third floor. These deliver from either elevator to either of two bins serving the bag packers. One of these cross screws extends out of the building over a loading track and discharges through a 6-in. rubber hose into cars for bulk shipments. An air jet in the hose keeps the cement from sticking.

Two Bates 4-bag packers fill the cloth or paper bags in which the cement is shipped. Each packer discharges to a belt conveyor, one to each side of the building, where the cement is loaded into cars by hand trucks. Bag weights are checked occasionally on Fairbanks springless dial scales. Each of the conveyors is driven by a 5-hp. General Electric motor through a James speed reducer.

An Otis freight elevator serves the various floors of the packhouse. The fourth floor houses a Modern Valve Bag Co. bag cleaner and a Northern Blower Co. "Norblo" grid-type dust collector. This is of the low suction type and serves the two Bates packers and the bag cleaner. On the third floor are sorting tables served by a belt conveyor, Singer sewing machines, and Bates bag tiers. The entire second floor and part of the fourth floor are utilized

Top of slurry tanks with feed lines and valves. Housing is over electrical equipment and slurry-agitator drive motors.

Looking down on the two kilns from the feeder floor.

for the storage of new and returned sacks.

There are track storage facilities for 30 empty cars and 30 loaded cars on each side of the packhouse. Special switches and side-tracks allow empty sacks to be unloaded and cars switched without interference to loading. No truck shipments are made.

Design and Construction

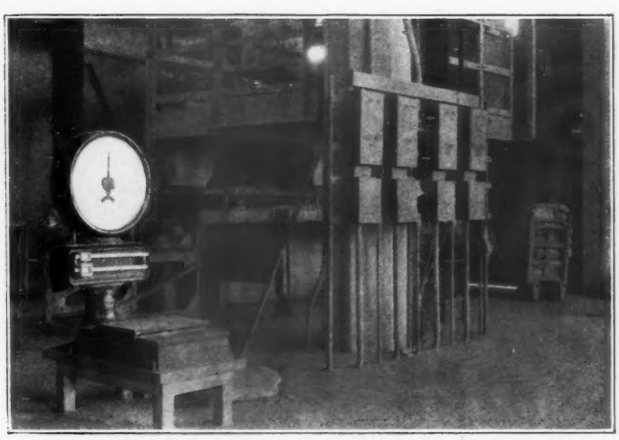
The plant site was selected and tested and the plant was designed throughout by the Terrell Bartlett Engineers, Inc., with R. K. Meade & Co. as consultants. The construction of the plant and erection of all equipment was carried out by the forces of Smith Bros., Inc., general contractor, under the superintendence of A. F. Sayers who is now plant superintendent. Subcontracts were let to the Bland Engineering Co. for the slip-form construction of stock and packhouses and slurry tanks, and to the Heine Chimney Co. for the two 200-ft. kiln stacks.

The kilns, coolers, and mills were furnished by the Allis-Chalmers Mfg. Co. The General Electric Co. furnished most of the electrical equipment including motors, controllers, transformers and switchboards. Crouse-Hinds conduit and Hewitt Gutta Percha conveyor belting are used throughout. Conveyor idlers and drives were furnished by the Link-Belt Co. All motors are direct-connected through James speed reducers or Falk-Bibby flexible couplings.

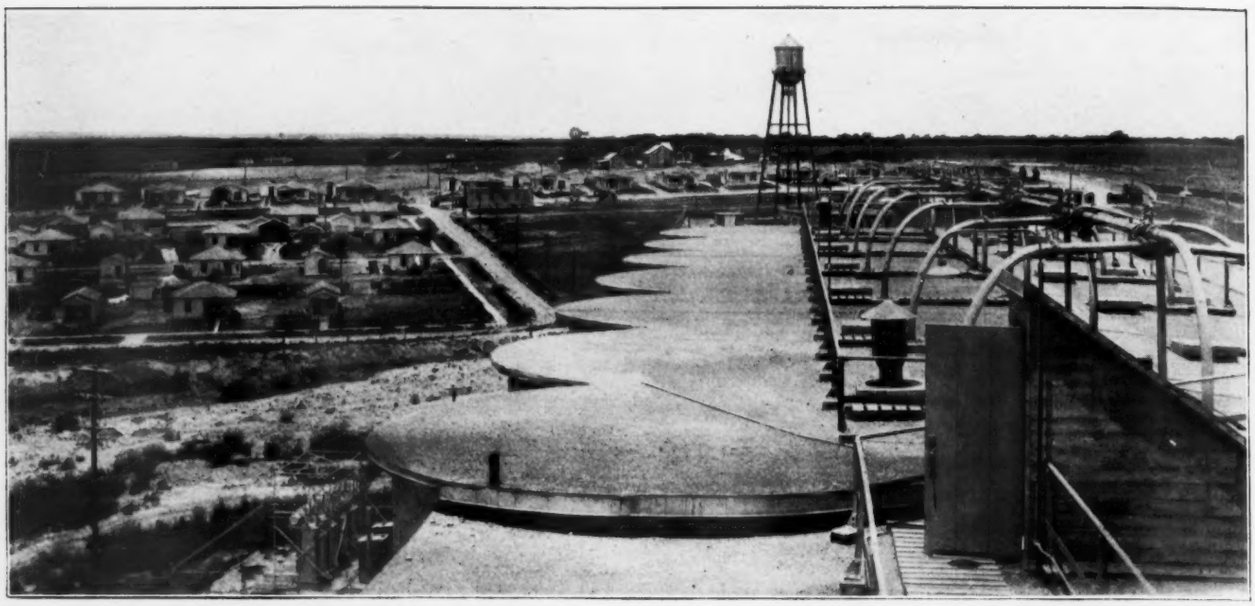
With the exception of the P & H crane spanning the open storage, all overhead cranes were furnished by the Box Crane & Hoist Co. Two 5-ton overhead cranes in the mill room handle all repair and replacement parts for the mills, motors, and electrical equipment. A 10-ton electric crane over the crusher performs the same service.

As has previously been stated, the policy of the company was to use concrete in the construction of the plant wherever practical. This decision was made not only because of the comparatively low cost of concrete compared to steel in this section of the country but because of the nature of the industry for which the plant was being built. Structural steel, therefore, was used only for long spans or to facilitate future enlargements of the buildings. Corrugated cement asbestos was used for sloping roofs, cement tile or stucco for walls and gunite for flat roofs.

The design of the plant is such that the kilns can be lengthened without hitting the stacks. A third kiln can be readily installed by adding a row of columns to the present kiln building and attaching new roof trusses to the present ones. Additional mills can be added by extending both sides of the mill building, the end framing of which is of structural steel. Mill feed bins can also be readily added as



One of the cement packers with loading conveyor. Dial scale at left.



View of village from top of cement packhouse looking over cement storage silos. Plant substations at lower left.

dowels were left in the walk to provide for future additions.

Many interesting problems were encountered in the design and construction of the plant. One of these was the unusual foundation condition under the grinding mills which had their feed ends on soft rock with the drive ends on clay. Rigidity of the motor, shafting, and gears is important. Each of the four mills weighs over 200 tons loaded and rotates at a speed of 20 r.p.m. This condition was successfully met by placing the feed end of each mill on an individual foundation on rock and the drive ends with shafting, motors, and the intermediate building columns on a single heavy reinforced concrete mat of large area. With this exception all plant foundations are on bed rock.

The type of construction used gives the plant a very pleasing appearance due in part to the prevalence of concrete over steel construction. The village also was laid out with its appearance in mind as well as comfort and permanence. All of the ground around the plant and village was sodded and planted with shrubs, trees and flowers, and even after a year's time the results are very noticeable. The absence of dust from the plant, due to the efficient system of dust collectors, also has much to do with the appearance of the surroundings.

A portion of the well-equipped physical testing laboratory.

Laboratories and Other Buildings

The laboratory building is unusually complete and well equipped and has facilities not only for the regular chemical and physical tests but for experimental testing as well. An unusual service is provided for contractors, engineers, and others interested in the use of concrete. Aggregates for a construction project can be submitted here and the company will figure the most economical mix to be used. Test cylinders are stored and broken at the laboratory for local construction jobs and reports of the tests submitted. The laboratory is also equipped to make tests of concrete block and tile, and reinforcing and structural steel.

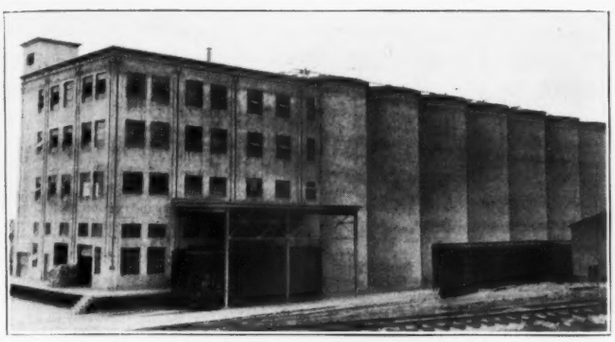
The rotary clinker coolers showing how they discharge through the storage wall.

The chemical and physical testing laboratories are both located in a neat stucco and tile building near the plant. The chemical laboratory is equipped with the usual water-distilling apparatus, electric ovens, hot plates and analytical balances.

The physical testing room contains such equipment as: a Tinius Olsen tensile tester, a Tyler Ro-Tap sieve shaker, a Braun Type VA pulverizer, Sargent balances, pot boilers, moist box, and Gilmore and Vicat needles. An unusual method for quickly determining the fineness of a material is used here. This consists of a wash basin with a pressure gauge and spray which washes the material through a 200-mesh screen. A pressure of 15 lb. for 1 minute is said to give very satisfactory results.

The concrete research room has a moist closet with a Frigidaire system and hot water heater to regulate the temperature and a Bristol recording thermometer. There are also: a Sargent autoclave for testing soundness, a Fairbanks springless dial scale with a special dial which measures in ounces or grams, a concrete and steel table for breaking beams and a small electrically-driven concrete mixer of own design. In a separate room is a Tinius Olsen 300,000-lb. compression-testing machine.

Part of the chemical testing laboratory.



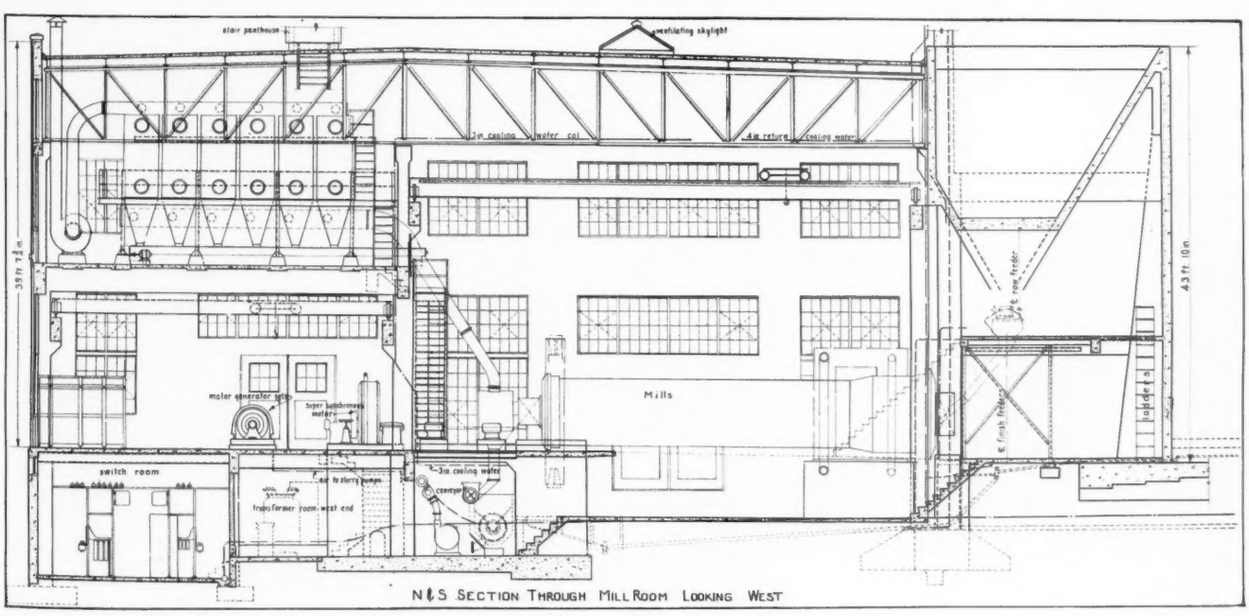
The packhouse and cement-storage silos from the northeast.

Alongside the belt conveyor which carries the raw material to storage is a large concrete and steel service building. This houses a machine shop, storehouse, electric shop and wash-and-change house. A sidetrack alongside this building facilitates the unloading of repair parts and allows any equipment to be brought into the shops for repairs.

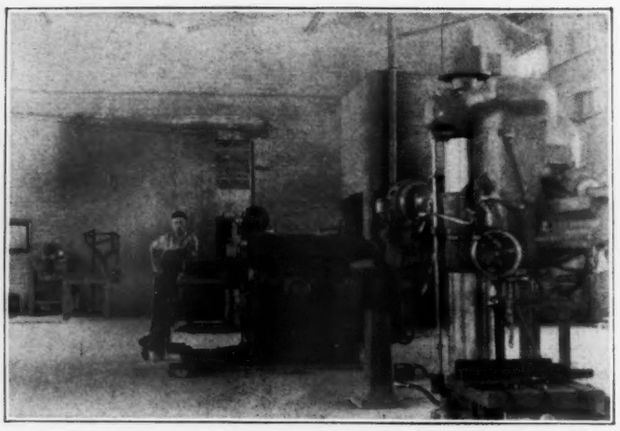
The machine shop is unusually well equipped. The major equipment consists of: a 3-ft. radial drill-press, a 24-in. shaper, and a 14-ft. bed lathe, all furnished by the American Tool Works Co.; a Beaudry Co., Inc., 100-lb. triphammer; a Canedy-Otto Mfg. Co. drill-press; a Greenfield Top & Die Corp. bolt threader; a U. S. Electrical Tool Co. emery wheel; an Oxweld acetylene cutting and welding set; a General Electric arc welder; and a compressed-air forge. A 5-ton Box overhead electric crane handles repair and replacement parts. The storeroom contains a Fairbanks portable scale and a D. Round & Co. portable crane.

Electrical Data

Electric power is purchased from the San Antonio Public Service Co. It is furnished from a 76,000-volt loop between New Braunfels and San Antonio feeding a 3,750-kv.-a. substation at the plant which



Section through mill building showing dust collector at upper left with electrical controls, switchboards and transformers below. Kiln feeders and bins at right.



Interior of machine shop showing part of the modern equipment used.

is operated by the power company. The loop is fed by a 60,000-kv.-a. steam generating plant at New Braunfels, a 9,000-kv.-a. hydro-electric station at McQueeney, and a 35,000-kv.-a. steam station at San Antonio. Because of this three-station loop it was not considered necessary to provide for an auxiliary to operate the kilns in case of an emergency.

The location of the electrical equipment and compressors at the plant varies somewhat from the customary cement mill practice. These are in the mill building where control of the entire plant is centralized. An Ingersoll-Rand Class ER-1, 17-in. by 12-in. compressor furnishes air at 40-lb. pressure for slurry agitation. This is driven by a 100-hp. synchronous motor. Two Ingersoll-Rand Type XRE compound 11-in. and 18-in. by 14-in. compressors furnish air at 100 lb. for the Fuller-Kinyon pumps. These are driven by built-in 175-hp. synchronous motors. The intake of each compressor has a Reed air filter to protect it against dust. A motor-generator set furnishes d.c. power for variable speed motors and excitation for the mill motors.

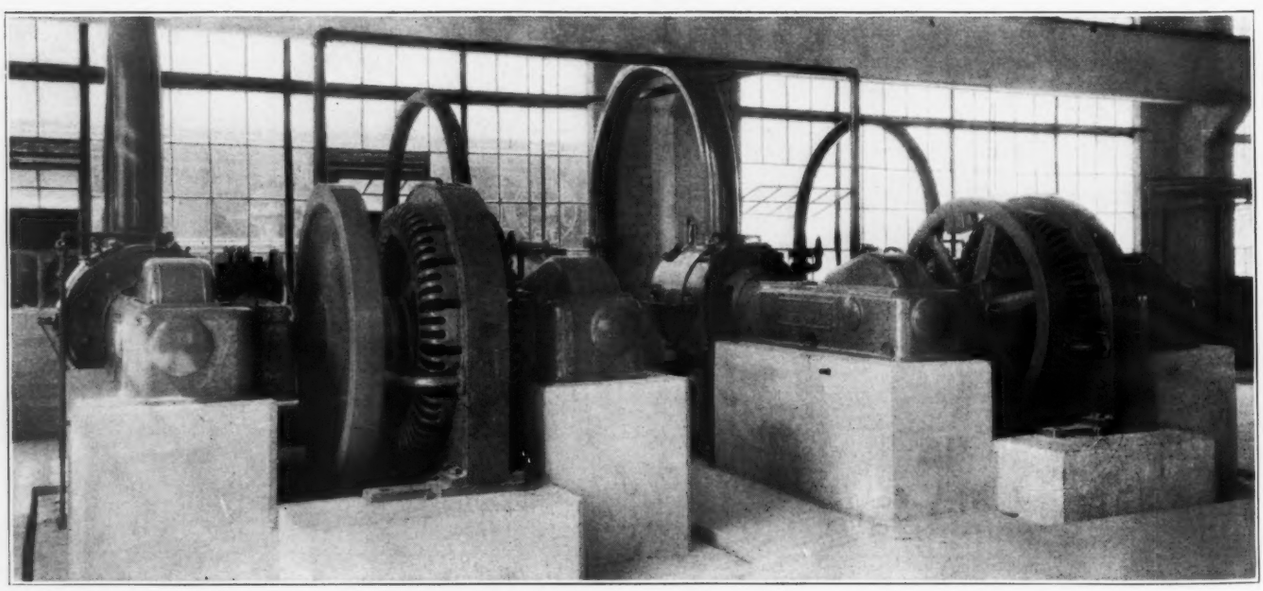
The main plant switchboard is on the main floor of the mill building while the compensators and transformers are in the basement below. The switchboard is 49 ft. long and includes separate panels for all of the various plant departments. An "Edmoore Power Demand Limitator," manufactured by Edward T. Moore, was installed to cut power costs. This automatically reduces the load to one or more of the power-consuming units at the time of excessive load and restores the load when it is safe to do so. The master control of the Limitator is installed on the incoming line panel of the main switchboard.

The Limitator may be readily and permanently set for any predetermined load value or may be reset to correspond with seasonal variations or other fluctuations. When the load exceeds the setting, one of the motors driving the three compressors is automatically unloaded. If this is not sufficient, the second and third motors are also unloaded. When the load again falls below the setting these motors are promptly reloaded. As these unloading periods are of short duration, no drop in receiver pressure ensues. Control of the integrated or average load over a demand period of 15 min. is accomplished by tripping out one or more of the tube-mill motors. After the expiration of the demand period a signal is given the operator and these motors may then be started. A switch allows the motors for the mills which have the most stock ahead to be selected.

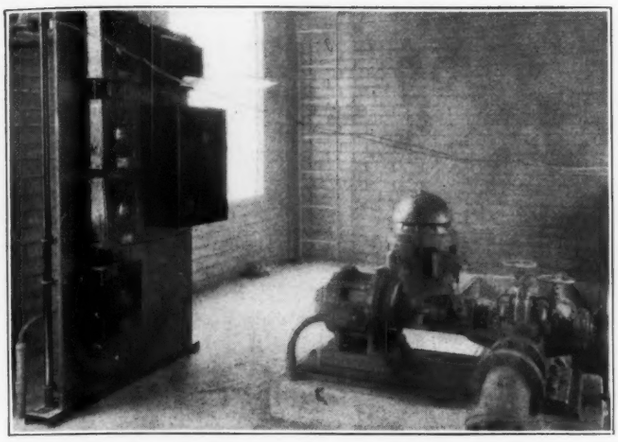
Fuel and Water

The natural gas used for kiln firing is purchased from the Southern Gas Co. This is received at the plant at 200-lb. pressure and is reduced by the gas company to 50 lb. A reducer house owned by the cement company further reduces the gas to 10 lb. A further reduction at the burning floor brings it down to between 1 and 1½ lb. for the kilns. The same gas is piped to the laboratories and to the employees' homes.

Provision has been made to use oil for kiln fuel



The two large air compressors on the main floor of the mill building.



Interior of pump house showing one of the deep-well pumps.

in case of a failure in the gas supply. Mounted on the burning floor is a General Electric centrifugal compressor driven by an 85-hp. motor, a fuel tank with sufficient capacity for 40 hours' run, and two Viking high-pressure oil feed pumps. An R. K. Meade oil burner is kept in storage. All of this equipment can be connected up and put into operation on 2 hours' notice. As there are several oil refineries within a few miles of the plant an ample supply of fuel is assured.

The pump house furnishing water for the plant and village is a neat concrete building located near the crusher house. Two Pacific Pump Works turbine-type pumps, one with 300 and the other with 500 g.p.m. capacity, supply the water from two 385-ft. wells. These pump into a 50,000-gal. capacity underground storage tank from which a Goulds size 4 centrifugal pump supplies a 50,000-bbl. steel water tank at an elevation of 100 ft. This standpipe furnishes all water for the plant and village. It also serves the fire protection system which has plugs located at convenient points.

Very little water is wasted in the mill in order to prevent the wells from running dry during some of the prevalent droughts. The water used to cool the bearings for the kilns, coolers, and mills is drained to a concrete sump under the mills. A small Goulds pump returns this water to a 2,000-gal. tank above the mill building to be used in the slurry. The use of this tank, which has regulating valves controlled by floats, insures a constant pressure and volume to the mills, resulting in a uniform water content in the slurry. A connection with the large standpipe keeps this tank full at all times. Crane valves and fittings are used throughout the plant and village.

Gypsum is purchased at points within economical shipping distance of the plant. A track for unloading the gypsum from cars runs alongside the clinker storage adjacent to the gypsum storage bins.

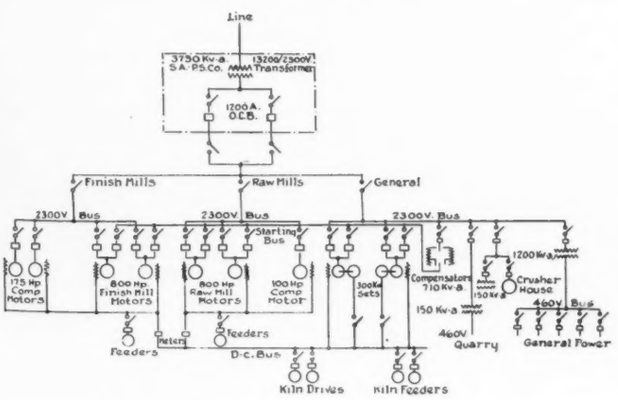


Diagram of power-distribution circuits in mill.

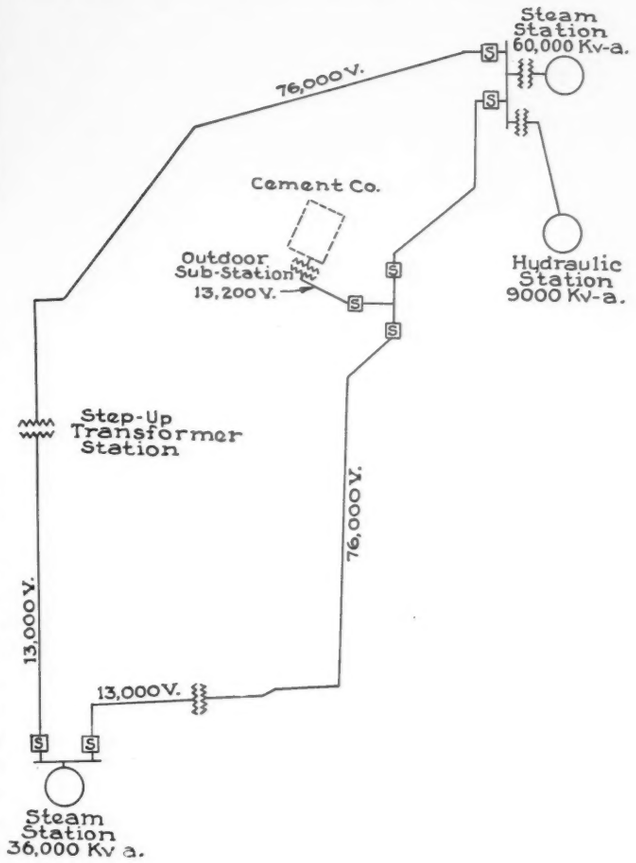


Diagram of power stations supplying the plant.

A typical analysis of the clinker and cement is given:

	Clinker	Cement
SiO_2	21.51	21.02
Fe_2O_3	2.91	2.17
Al_2O_3	6.97	6.39
CaO	67.50	66.78
MgO	.70	1.08
SO_3	0.00	1.74
Loss	0.00	.81

The village of Longhorn, which was built by the company for its employees, consists of 56 houses and a commissary. Each house is provided with electricity, gas, sewer, and water, and rental is very low. The village is divided into three sections for white, Mexican and negro employees. Incidentally, 60 per cent of the employees are white. The commissary provides for most of the requirements of the employees and their families at prices comparative to those in chain stores.

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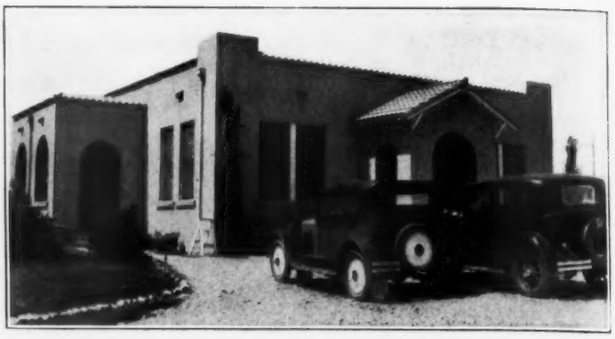
The cement produced, under the brand name of Longhorn, has, in the year since the plant started to operate, acquired an enviable reputation. The reason for this is evident from the results of tests that have been made. One series of tests made by the State Highway Department showed a compressive strength of 6,800 lb. at 28 days with a 1:2:3½ mix and a 1½-in. slump. A 6-in. slump under the same conditions showed a strength of 5,200 lb.

Reports from a number of testing laboratories in the Southwest show tensile strengths averaging 322 lb. at 3 days, 425 lb. at 7 days, and 520 lb. at 28 days. The initial set takes place in 3 hr. 15 min., and the final set in 5 hr. 25 min. A fineness of 89.5 per cent through 200 mesh and 80 per cent through 300 mesh is shown.

The commissary and filling station with office, water tank and laboratory in background.

A playground for the children is also provided, as well as tennis courts and baseball diamonds. The drinking water from the two wells previously described is remarkably good and is the same as that in the city of San Antonio. The sewage disposal system has an improved type of Imhoff septic tank such as is used by small villages.

Left to right: Frank Smith, chief clerk; George Hunter, auditor; E. G. Spencer, assistant superintendent; George P. Horn, chief chemist; R. F. Sayers, superintendent.



The attractive plant office building.

The plant office, like the laboratory and commissary buildings, is a concrete and stuccoed cement-tile building. It fronts the main entrance to the plant from the highway. In addition to the general offices there are private offices for the superintendent and his assistants.

The main office of the Republic Portland Cement Co. is at 1101 Smith Young Tower, San Antonio. Officers and personnel are: J. H. Smith, president; J. Catto, Jr., general manager; Ben R. Collins, purchasing agent, secretary and treasurer; A. F. Sayers, superintendent; George P. Horn, chemist.

Sales of Kaolin and Other Clays Show Slight Gain During 1929

The quantity of clay sold by the producers in the United States in 1929 amounted to 4,347,020 short tons, valued at $14,850,744, according to a statement made public by the United States Bureau of Mines, Department of Commerce. These figures show an increase of 8 per cent in quantity and 5 per cent in value compared with 1928. They represent only clay sold as clay or mined under royalty and do not include the much greater quantity of clay that was burned into clay products by the producers themselves from their own property.

Phosphate-Rock Producers Enjoy Banner Sales Year in 1929

Phosphate rock sold or used by producers in 1929 exceeded all previous records except for 1920, and amounted to 3,761,164 long tons, valued at $13,153,259, according to a statement by the United States Bureau of Mines, Department of Commerce, based on figures compiled from individual reports by the producers.

Florida held first place, as usual, and was the source of 82 per cent of all the phosphate rock sold or used by producers in the United States in 1929, the same as in 1928. Land-pebble rock constituted 98 per cent of the Florida output in 1929, and showed an increase of 8 per cent in quantity and 7 per cent in value, as compared with 1928; the average value f.o.b. mines was $3.21 a long ton in 1929, as compared with $3.28 a ton in 1928. The hard-rock production in 1929 decreased in both

quantity and value as compared with 1928. The average value f.o.b. mines in 1929 was $3.67, as compared with $4.00 a long ton in 1928. The production of phosphate rock in Tennessee in 1929, consisting of brown and blue rock, showed an increase of about 10 per cent in quantity, and about 8 per cent in value, as compared with 1928. The production of brown rock constituted more than 90 per cent of the total. The average value per long ton was $4.89, as compared with $4.95 in 1928. The quantity of phosphate rock sold or used by producers in the western states in 1929 decreased 5.5 per cent as compared with 1928.

Although the total sales of phosphate rock by producers in 1929 increased 7 per cent in quantity and 6 per cent in value, as compared with 1928, there was continued decrease in production of Florida hard-rock and continued decline in the domestic market for phosphate rock in the Western States. The average selling value of all varieties was $3.50 f.o.b. mines, as compared with $3.55 in 1928.

Imports in 1929, about 2 per cent less than in 1928, amounted to 44,899 long tons, valued at $469,171. Exports were the largest of any year except 1903, being 1,142,746 long tons, valued at $5,386,919, according to the official records. Producers in Florida alone reported shipments during 1929 from the mines for export. These export shipments amounted to 1,110,325 long tons, consisting of 94 per cent land pebble and 6 per cent hard-rock, which together constituted 36 per cent of the total sales in Florida in 1929, and showed an increase of 25 per cent as compared with 1928. The output of land pebble in Florida increased 8 per cent in 1929 over 1928, and this increase was apparently all accounted for in the exports, as shipments of land pebble to domestic markets were less than in 1928. Total sales to domestic consumers, which comprised 64 per cent of the Florida sales and all the sales of the other producing States, Idaho, Montana, Tennessee, and Wyoming, indicated a small increase in the quantity of phosphate rock consumed in the United States in 1929 as compared with 1928.

Proper Dressing an Important Factor in Leather Belt Performance

By a peculiar accident, the words Barnum, bunkum and belt dressing all begin with the same letter of the alphabet. When we reflect on the similarity between many of the products sold as belt dressing and the bunkum of Barnum's day, we are convinced that it is not so much of an accident after all, according to *Black and White.*

Leather belting is a popular means of transmitting power because leather of the proper weight, properly tanned, has great strength and a high coefficient of friction on its surface. As long as leather retains its flexibility and resiliency, and its surface is kept clean, it will retain this high coefficient of fraction. If the surface of a leather belt would be improved by the application of some sticky belt dressing, you can be sure that some enterprising belt manufacturer would put a belt on the market with such a surface, for with a belt of much greater pulling power the road to sales would be easy. The reason that sticky belt dressings are not used nor recommended by any belt manufacturer is that they are just about the worst thing you can put on a good belt.

Since a leather belt with a clean, resilient surface will outpull any belt in the world whose surface is coated with the sticky belt dressing obtainable, it certainly seems logical that the way to retain the pulling power of a leather belt is to retain its resiliency rather than to cover up its natural surface with a mucilaginous mass.

Some oak-belt manufacturers take such great pride in the first appearance of their product that they polish down its running surface so that it has no gripping power at all, with the result that the user has to "run in" the belt for several hours before it will grip the pulleys. As soon as this polished surface has been worn off and the leather been given a certain amount of resiliency by the constant flexing over the pulleys, an oak belt has developed its maximum pulling power. It will retain this pulling power as long as the surface is kept clean and the belt does not dry out and become too hard.

Oak belting, however, is very heavily stuffed with currier's grease. This grease, like all others, is composed of a liquid and a solid blended into one another. The result is that the liquid part of the grease is pounded out of the belt in service, leaving only the solid part in the leather. The logical cure, therefore, is to replace this liquid which has been pounded out and exhausted. Therefore, the best dressing for an oak-tanned belt is a light penetrating oil, applied to the belt, while it is at rest, with a brush and allowed to soak into the leather. Such a dressing will restore some degree of flexibility to an oak-leather belt and thereby restore the maximum pulling power of that belt. Special mineral-tanned leather seldom needs any dressing, unless it is running under hot, dry conditions. In such a case all that is necessary is to apply a little special belt *lubricant* with a brush and allow it to penetrate through the belt and again lubricate the fibers of the leather.

The only dressing that a leather belt needs is the regular lubrication of its fibers to retain the flexibility and resiliency of the belt. Sticky belt dressings do not lubricate the leather fibers and they cover up the natural gripping surface of the leather.

Bavaria Principal Source of Fuller's Earth in Europe

The principal source of supply of fuller's earth in Europe comes from the important occurrences of crude fuller's earth in Bavaria. The so-called Tonsil group, composed of Tonwerk Moosberg, A. M. Ostenrieder G.m.b.H. and Tonsilwerken G.m. b.H., has joined with Siriuswerke A.G., in a rationalization program. The new group now controls a major percentage of fuller's earth in Europe and has opened a joint office in Munich and is said to be associated with Dutch capital.

Some Accident-Prevention Problems in Crushed-Stone Operations

By W. DEAN KEEFER
Director Industrial Safety Division, National Safety Council

THERE has been splendid progress during the last few years toward accident prevention in crushed-stone operations. This is indicated by the fact that an increasing number of companies, which make the crushing of stone either their chief or one of their major operations, have adopted definite accident prevention programs. It is further proved by the remarkable accident prevention records of some of these companies.

Because stone-crushing operations are so closely associated with general quarrying operations, it has been impossible to get complete accident statistics exclusively for stone-crushing activities. There are fairly complete accident statistics for both the quarry and the cement industry. In fact, both of these industries are highly organized in accident-prevention work, including nationwide safety contests which create a great deal of interest in individual plants. But the accident reports for the rock-crushing activities of these two industries usually have not been segregated. Likewise, the construction companies which make rock crushing a major activity and who report their accident experiences to the Construction Section of the National Safety Council do not report their rock-crushing operations separately.

However, there has been enough segregation of accident experience in rock-crushing activities to warrant general statements. It has been said by specialists in this field, first, that the accident rate of the quarry industry as a whole is considerably higher than the accident rate of the crushed-stone division of this industry.

In the second place, the accident rate of the quarry division of the cement industry, as the result of highly-organized safety work, has been brought down far below the average of the accident rate of the crushed-stone division of the quarry industry.

As a third general statement, a good many individual companies engaged in crushed-stone operations have been able to lower their accident rates far below the average of the industry as a whole.

One of the factors in the development of interest in accident prevention work among companies which make the crushing of stone their major activity has been the annual awarding of special safety trophies by *The Explosives Engineer* to winners in the National Safety Competition in the quarrying and mining industries. This contest, organized about five years ago, is conducted by the Bureau of Mines for the underlying purpose of the promotion of safety in the mineral industry. Approximately 300 mines, representing 30 different states, have taken part in this contest each year. The contestants are divided into the following five groups: anthracite coal mines, bituminous coal mines, metal mines and non-metallic mineral mines, quarries and open-pit mines.

This contest has been given special significance to companies engaged in crushed-stone operations by the fact that *The Explosives Engineer* offers a special award each year to the company member of the National Crushed Stone Association that shall achieve the best individual safety record.

This award, for the year 1926, was given to a crushed-stone company which was able to operate two quarries throughout the year without a single lost-time accident. In 1927, three different company members of the National Crushed Stone Association operated with perfect no-accident records. For 1928, five quarries had perfect records. One quarry has operated four successive years with a perfect no-lost-time-accident record.

Some of the benefits that may be expected from an accident prevention program have been suggested by a statement made by John Rice, president of the General Crushed Stone Co., whose White Haven quarry was the winner of the 1927 safety trophy. He stated, before an Annual Safety Congress of the National Safety Council, that "A questionnaire to our superintendents as to the effect of the movement discloses in their judgment a distinct improvement in the morale of their men, a greater interest in their work, and many resulting economies. As one expressed it, they have all come to realize that a trained man on the payroll is a lot more valuable than on a compensation list. . . . . I cannot reduce to dollars the resultant benefits of this intensive safety movement on our part, but I believe it is no exaggeration to say it has effected a saving of 10 per cent in our operating expenses and 30 per cent in our accident expense."

A further testimony was added by O. M. Graves, an official of the company, in a discussion before the Quarry Section of the 1928 Annual Safety Congress. In discussing the safety program of the company, Mr. Graves said that "It seems to me that the thing I admire most is that the men do the things they ought to do because they want to do them. They want to do them primarily because they like the head of the company; they want to do what Mr. Rice wants to be done. This pervades the entire organization.

"Also I think they try to do the things they ought to do, not only because of their affection for the company, but because the things they are asked to do are reasonable things. They recognize the propriety of the system under which they are working. And that being so, certainly we have felt, in our safety efforts, which are relatively new, that, if we could make men understand that we were in earnest

(*Continued on page* 45)

The Place of the Electrical Maintenance Engineer in Plant Operation

By R. H. ROGERS
Industrial Engineering Dept., General Electric Co.

A MANUFACTURING plant may be said to be as old as the electrical installation contained therein. Since electrical equipment is to a great extent mobile, worn or obsolete equipment may be replaced, units can be interchanged, and a variety of improvements may be made affecting only one part of the plant and, in general, necessary improvements can be made without affecting production.

Due to the great flexibility and the relatively small space required by electrical power units, many opportunities exist whereby it is possible to maintain modern standards and prolong the active life of the plant. In some cases, however, the plant buildings or their location may become obsolete, or worse yet, the product may no longer meet a popular demand. In such cases no amount of rehabilitation can stave off the end.

One writer recently tersely stated that every plant has two junk piles, one outside the walls and one inside the walls. The size of the inner junk pile can be kept down by the maintenance men whose primary business it is to keep things from happening. Only slightly less important is their function of recommending modernization, for no one in the organization is in better position to see what is needed and when it is needed to hold obsolescence down to a figure that will insure a reasonably long life for the plant.

Suppose some major equipment is put in today and that it is the best procurable for the purpose—call that par or 100. Depreciation starts immediately but its progress will be slow or fast according to the diligence of the maintenance forces—to check it to a standstill is impossible. In a period of 10 years its condition may be called 90 or 10 below par. In the meantime that class of equipment has been improved and a competitor installs it. That equipment may well rate 140 on the old basis or 50 points better than the 10-year-old equipment that is still going strong.

Obsolescence has gotten in its work four times as fast as depreciation. Electrical maintenance men should keep a sharp eye on this phase of plant ageing and should, by letter and sketch, make pertinent suggestions on ways and means to keep up perpetual rejuvenation.

Electrical men connected with the industrial world are in a strategic position to foster modernization at least to the extent of making it possible for a plant to hold-its-own and, in many cases, keen concerted action on the part of the electrical forces have shoved an institution up among the leaders in its line.

That is the broad view to take—know what is the best, what the trends are; press relentlessly for modernization; install conscientiously and maintain intelligently.

Maintenance may be of the "main-strength" type where without question the same sort of repairs are made over and over on the same units. They are kept going, it is true, but at high cost. We are prone to become "mill-blind" unless we specifically guard against it. Shop troubles can repeat themselves until we are calloused to them and we assume without question the routine of making certain repairs or replacements periodically.

Intelligent maintenance implies that thought will be given to the cause of every failure which leads to maintenance expense. The unit in trouble must be studied first and if no cause is apparent the search must extend both ways from the trouble point until the cause is run down and eliminated once for all. This latter procedure is especially applicable to electrical equipment. Take, for instance, a case of motor trouble, perhaps the second occurrence. A study of the motor should include its starting duty, peak loads, average heating load, power factor and general behavior. If the motor has the proper characteristics for its work the examination should narrow down to physical and electrical conditions. If the cause of the trouble is not found here the investigation should be extended to the driven load to determine if erratic conditions can occur to throw destructive loads on the motor. The power supply and control items should be investigated. Some inexperienced person may be mishandling the equipment. Voltage dips from some remote cause may be the offending item. The control equipment may not be adapted to the application.

Periodic Studies Necessary

Periodic studies should be made of electric power equipment because improvements are being made all the time by manufacturers and a type of equipment unsuited to a job five years ago may be the ideal unit today, while on the other hand the accepted standards of a few years ago are obsolete now and newly fitted-out plants are being benefited by the improved designs and higher standards of the present. Any motor or control over five years old should be coldly scrutinized for present day fitness, so rapid has been electrical design progress. How is the management to know when to modernize or how except by the suggestions of those closely in touch with things as they are and as they should be?

Don't be complacent; don't be satisfied with things as they are; competitors are not. Have ideas about improving electrical conditions, push them,

* Presented to the Electrical Maintenance Engineers Convention at Cedar Point, O., June 19, 1930.

put them in writing, in sketches. Many schemes teeming with potential benefits have died in the heads or desks of the schemers because they were not brought out forcibly enough. Some may be too modest to bring their notions to those higher up while others become discouraged at the first belittling comment. Worst of all is the "main strength" maintenance man who takes the attitude that he is not being paid to improve conditions and maintains that he is there simply to keep things running as they are.

Some of the trends in electric practice that are most responsible for obsolescence in existing equipment may be summarized to advantage.

Synchronous Motors

Synchronous motors have been so improved particularly in starting characteristics that they are now freely applied where, but a few years ago, induction motors were used. Synchronous motor control has also been improved in many ways among which are the prevention of stalling on undervoltage, etc. Full advantage can be now taken of the power factor improving characteristics of synchronous motors together with their inherent adaptability to low-speed drives. The substitution of synchronous for induction motors at certain key points in plants has materially helped the normal operation of all the other electric apparatus and has made it possible to add much needed motor loads within the heating capacity of existing transformers and feeders.

Time-delay under-voltage relays on all large motors are helping to maintain continuity of service. They allow motors to coast through voltage dips of short duration and save wear and tear on the whole system which results from wholesale restarts after a momentary outage.

The wide and growing use of generator voltage-control (Ward Leonard) for d.-c. motors in the presence of a.-c. supply has done much to reduce maintenance and increase production. It is agreed that d.-c. machines have higher maintenance costs than those of squirrel-cage induction motors but, considering all the factors generally, lowered maintenance cost is often a determining factor in favor of the d.-c. generator voltage-control system. This statement of course applies only to such duties as call for the characteristics of this type of drive. An example is the power shovel. It can be driven by a single or several a.-c. motors. It can be driven faster with less lost time and less maintenance cost by d.-c. motors under generator voltage control in spite of the fact that an a.-c. motor is still required besides a d.-c. generator for each motion. The same is true of mine hoists, steel mill main-roll drives and some twenty other applications common to industrial operations.

Among minor items are the more general use of the indestructible one-piece winding for squirrel-cage induction motors; improved bearings which have longer life and furnish better protection against the transfer of oil to the windings; and the general practice of extra bracing the coils to withstand the stresses of full voltage starting.

The practice of full-voltage starting of motors has been extended to very large sizes, 3,000 hp. in one case and very commonly to 500 hp. This practice involves simpler starting devices and consequently less maintenance—provided the driven machine does not suffer from the mechanical shock that the quick start may inflict upon it.

Standard listed motors today are better protected from water, humidity, acid, alkali fumes and abrasive dusts than were the motors of a few years ago. Research in these matters has resulted in the production of age-resisting insulations and better manufacturing procedure thus producing better all-around units for all classes of electrical service.

Lightning protection has been the subject of much study, and progress in keeping with the efforts expended has been made. Today, for instance, the transformer is practically lightning proof and outages from lightning surges are becoming more and more rare.

Improvement in the design and construction of electrical units has carried with it corresponding improvements in spare parts. This is especially true of insulated parts, which can now be kept in stock for long periods without deterioration.

Brakes and braking systems have changed for the better in many respects. Brakes themselves require much maintenance and are often the unsuspected cause of maintenance expense in motors and driven machines. Alternating-current solenoids are passing, electro-hydraulic brake releasers taking their place. Motor generators are furnishing d.-c. to brake solenoids in many cases where a.-c. solenoids were formerly used. Dynamic braking and regenerative braking are stopping thousands of shafts where formerly brake bands and wheels were being worn out.

Power-factor improvements present one of the most fertile fields for inside investigation. Additions, transfers and substitution of units can be plotted graphically to determine the effective means for power-factor improvement with little expense. By such procedure one may find ways to better electrical conditions within the plant and often advantage can be taken of the power-factor clause in the power contract. Means for improving power factor are found in the use of high-speed, fully loaded induction motors, synchronous motors of unity or leading power factor, capacitors, or synchronous condensers. Simple automatic means are available for holding a predetermined power factor in a plant through thick-and-thin. Economies by power-factor improvement are well worth trying for because once in effect they accumulate to the advantage of the plant day and night, year-in and year-out.

Electrical men are thoroughly familiar with the ordinary problems of installation and maintenance. Instructions and standard practice take care of most of the troubles that arise. It would be superfluous to urge these experts to be sparing of oil, to blow the dust out of electrical machinery, to check air gaps and to carry on the thousand and one services that are conducive to continued operation.

On the other hand, if the broader spirit of scrutiny, which makes each unit prove its own merit, can be popularized, something worth while will have been accomplished.

The Fyler Ave. Plant with octagonal cement-storage bins and aggregate conveyor. Garage at left and aggregate-storage bins in back of plant.

Operates Four Pre-Mixed Concrete Plants Serving Builders in St. Louis

General Material Co. Employs 103 Trucks and Has Plans Under Way for Fifth Plant

By W. E. TRAUFFER

ONLY a few years ago central-mixed or mixed-in-transit concrete was a novelty, and as such was regarded with suspicion by the average user of concrete. This attitude was due, in part, to the fact that it was a novelty, and partly to the uncertain quality produced by some of the plants operating at that time. This, however, was a phase through which every young and rapidly growing industry must pass. Plant operators who did not know concrete have, in general, been succeeded by men who are well versed in the modern technique of concrete and the various types of construction for which it is used. The average plant today produces a consistently high grade of concrete under expert supervision to fit the needs of the user. This type of plant is rapidly overcoming whatever prejudice has been held against pre-mixed concrete by builders, contractors, and architects, establishing a confidence in this product that is rapidly becoming the industry's greatest asset.

H. F. Thomson, vice-president.

K. W. Lick, general superintendent.

The General Material Co., of St. Louis, Mo., has built up such confidence in its patrons by conducting its business along the most ethical lines. An honest

The Park Ave. plant from the street side showing both transit-mix and dump trucks being loaded.

attempt is made to apply on a commercial scale control features which are ordinarily thought of as laboratory methods.

This company, when originally formed, produced sand and gravel and operated material yards. In 1927 the first concrete plant at Park Avenue was started and the present business built up around it. Today the company's business is largely the production of concrete, although considerable building material is also sold direct.

The General Material Co. operates four plants in St. Louis, so located as to serve the entire city as economically as possible. These cover roughly a radius of about 15 miles from the downtown district at the flat prices charged for any haul of less than 5 miles. A large variety of service is possible in the metropolitan district due to the flexibility of the plants. All standard and some special sizes of sand, gravel, and stone, and all standard brands of cement sold in the local market, as well as special cements, are stocked. This, together with the use of both central-mixing and transit-mixing equipment, makes possible an unusual range of service.

Truck dumping a load of crushed stone to receiving hopper at the Fyler Ave. plant.

The Park Avenue Plant

The Park Avenue plant, at 4101 Park Avenue, is the largest of the four operated by the company, with a daily capacity of 1,500 cu. yd. of ready-mixed and transit-mixed concrete. It is located near the heart of the St. Louis industrial district and was the

Washing out bodies of the trucks after the day's work is over at the Fyler Ave. plant.

first wet-mix plant operated by this company, having begun production early in 1927. Its capacity makes it one of the largest single plants in existence.

It is an extremely economical plant to operate, largely because of its horizontal layout. The only elevating of materials required in this plant is the handling of aggregates from cars or stockpiles into truck-loading bins.

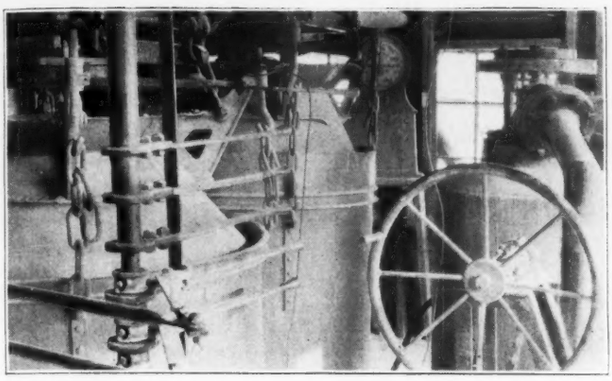
Two McMyler locomotive cranes equipped with 55-ft. booms and 1-cu. yd. Blaw-Knox Dreadnaught clamshell buckets handle aggregates from cars on a 20-car double-track siding to stockpiles or to six truck-loading bins, four of which are Blaw-Knox steel bins. Screens over the tops of the bins remove all refuse and any oversize. All of the bins have weighing batchers, four being equipped with the

Mid-West Scale Co. automatic dial scales and two with Howe beam scales with Weightograph attachments. Stone is brought in by truck from nearby quarries to this as well as the other plants.

The bins are arranged in a row with a concrete drive underneath so that trucks can be loaded with sand at the first bin and any kind of coarse aggregate desired at one of the other bins. Two Hug rear-dump trucks haul the batched materials to the mixing plant where they dump into the hoppers for the three Ransome 2-cu. yd. mixers and the transit mixing-truck batch hopper.

Sacked cement is added here by hand. This cement is unloaded from cars onto skids which are handled to the mixer or to storage by Lakewood lift trucks. The cement unloaded from each car is kept separate; each carload carries a "lot number" which is shown on the delivery ticket accompanying each delivery of concrete, an operating detail which is practiced in very few cities. An ample supply of all kinds of cement is carried so that any concrete desired can be made on a moment's notice. The special water-measuring device described later in this article is also used on all of the mixers at this plant.

Electric lift truck hauling cement and truck dumping aggregate to mixer at Park Ave. plant.



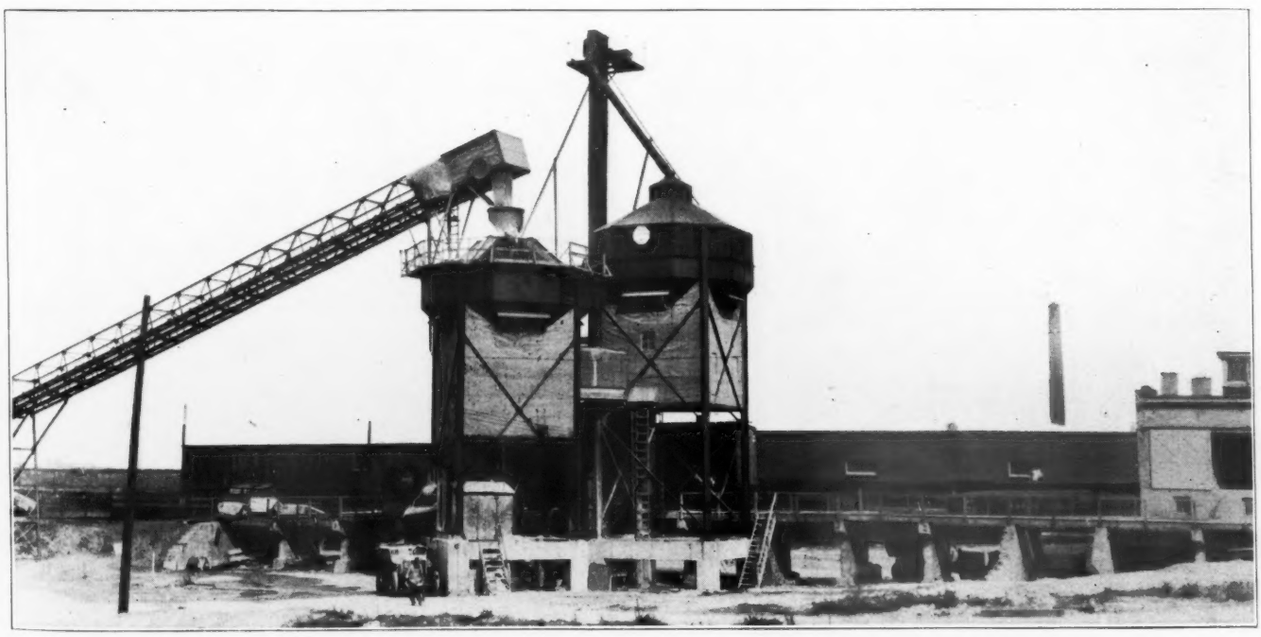
Weighing batchers and special water measuring tank at Fyler Ave. plant.

All the repair work for the company's four plants and fleet of trucks is done here in a well-equipped shop and garage. A number of the trucks are also stored here when not in use. The company maintains a repair truck equipped with an electric cutting and welding outfit for emergency repairs.

The Fyler Avenue Plant

The Fyler Avenue plant, at 4999 Fyler Avenue, is the newest and most pretentious of the four operated by the company and was designed for mechanical handling wherever practical. It is a mixing plant only, with a capacity of 900 cu. yd. per day and went into operation early in 1929. It is located in a rapidly growing residence and industrial section in the southwest part of the city and is of modern concrete and steel construction throughout.

The sand and gravel are received in hopper bottom dump-cars which discharge from a trestle into a long wooden bin underneath. This has a capacity of about 350 cars. Crushed stone is received in trucks which discharge to a concrete hopper at the



The Clara Ave. plant with conveyor for aggregates at left and cement-storage building at right.

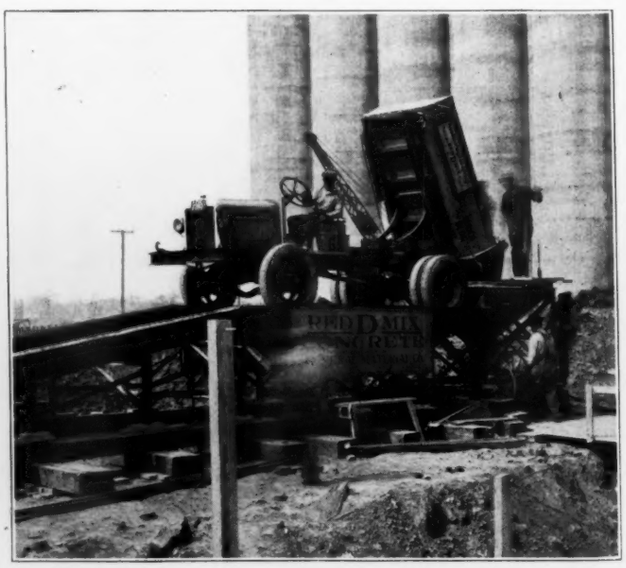
A view of the Park Ave. plant which shows the horizontal layout. The truck-loading bins. Cement-storage house

end of the bin. A short inclined belt conveyor discharges the stone into a separate section of the bin.

Under the large bin is a concrete tunnel 7-ft. square housing a 30-in. horizontal belt conveyor on 385-ft. centers. This feeds from the bin to a short cross conveyor which, in turn, feeds a 30-in. inclined belt conveyor on 285-ft. centers to the top of the mixing plant. This feeds, by means of a split chute with revolving spouts, into two 4-compartment Johnson 168-ton capacity Octo-bins above the mixers.

Cement is received in bulk and is unloaded by a power scraper into a hopper. An enclosed bucket elevator feeds through a 3-way gate and chutes into three Johnson Octo-bins with a capacity of 2,400 cu. ft. each. A screw conveyor feeds the cement from these bins to another enclosed bucket elevator to the mixing plant. A duplicate set of bins and elevators on the opposite side of the plant allows two cars of cement to be unloaded at one time and prevents any possibility of delay due to a breakdown. The elevators feed to a 40-bbl. capacity auxiliary bin which feeds the batchers. As each of the cement storage bins holds two carloads, cement is usually received two cars at a time and both are unloaded into a single bin; then this bin is emptied completely before more cement is placed in it, which arrangement permits the same practice as at the Park Ave-

Two-cu. yd. mixer ready to discharge at Fyler Ave. plant.



One of the dump trucks discharging to a large construction job.

nue plant of showing the "lot number" identity of the cement on the delivery ticket for each load of concrete.

The cement, sand, and coarse aggregate feed to two sets of three Johnson weighing hoppers

cranes at the right are loading aggregate from cars or stockpiles to the is in center with office at extreme left.

equipped with Mid-West dial scales. These discharge directly into the batch hoppers of the two Ransome 2-cu. yd. mixers. The same method of water control and mixer feeding is used here as in the other plants.

The sand bins have special Johnson 4-plate meniscus type gates. The bucket elevators, screw conveyors, and belt conveyors were furnished by the General Conveyor & Mfg. Co., and U. S. Rubber Co. conveyor belting is used.

The company also has a garage at this plant where most of the trucks for all the plants are stored. This is a modern concrete, brick, and steel structure.

construction and has a capacity of 450 cu. yd. per day of ready-mixed concrete only. This plant also went into operation early in 1929. It serves the northwest section of St. Louis and the adjacent suburbs.

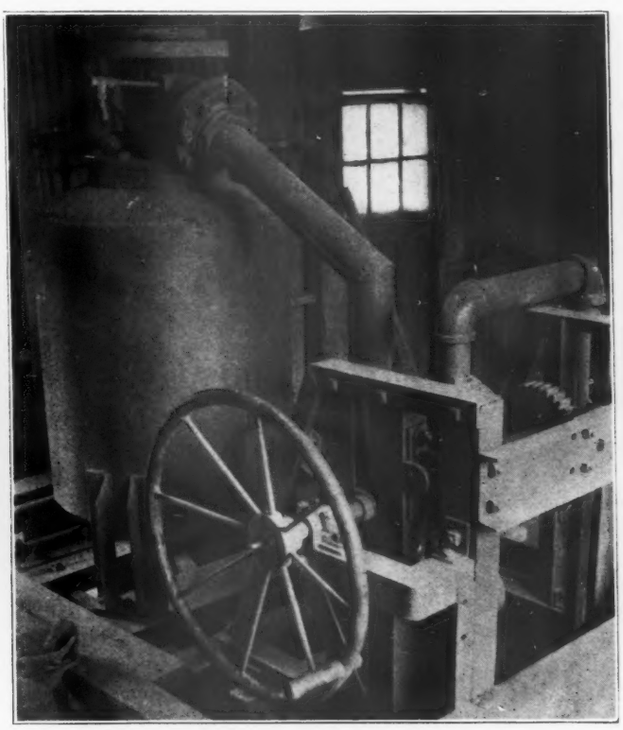
Aggregates are discharged from cars on a trestle to ground storage. A tunnel conveyor feeds a cross conveyor and inclined belt conveyor to a 4-compartment Johnson Octo-bin above the mixer. Cement is unloaded from cars by a power scraper and elevated to a 4-compartment Octo-bin, each compartment having a capacity of one car.

The cement is fed by two screw conveyors and the aggregates by gravity to Johnson weighing batch-

One of the transit-mixing trucks delivering concrete to a job.

The Clara Avenue Plant

The Clara Avenue plant, at 5617 Natural Bridge Road, is much like the Fyler Avenue plant but is considerably smaller. It is also of concrete and steel



Water-measuring tank of the company's own design.

The Branch St. plant which produces mixed-in-transit concrete.

ers equipped with dial scales which feed a Lakewood 2-cu. yd. mixer. Each of the cement conveyors can feed from either of two compartments to either of two cement weighing batchers, allowing instant selection of various kinds of cement. The conveyors are controlled by a mercroid tube switch which cuts off the power when the batchers are full to the required amount. This mixer is also equipped with the combined water-measuring and mixer-feed control mechanism.

The Branch Street Plant

The Branch Street plant is the smallest of the four, having a capacity of only 200 cu. yd. per day. It is used for transit-mixed concrete only and has no concrete mixers. This plant went into operation in 1928.

Aggregates are received in cars and unloaded by a crane to a 2-compartment Johnson bin equipped with weighing hoppers of the same make. These feed through a collection hopper to the truck-mixers. Cement is received in bags which are dumped into a small elevator discharging into a bin over the weighing equipment. The entire plant is controlled from the ground by lever and the weigh hoppers are equipped with dial scales which are visible from the ground.

Fifth Plant Is Planned

Plans are now being drawn for another operation —the fifth of the company's chain—to be known as the "Franklin Avenue Plant," which will be located at Twelfth and Franklin Avenues. As this location is very near the heart of downtown St. Louis, it will be possible to furnish a superior service in delivering to construction in the business district. Cement and aggregates will be received by rail. The equipment will comprise overhead bins and a single 2-cu. yd. mixer. Construction of this plant will be rushed to permit early delivery of concrete to important subway and building construction in the vicinity.

The company at present operates 103 trucks. This includes 60 Hug and 30 Pierce-Arrow trucks all equipped with pneumatic tires and special dump bodies. In addition to these there are 8 Paris Transit Mixers, 6 of 3½-cu. yd. capacity on White chassis and 2 of 2½-cu. yd. capacity on Hug chassis; also two 1½-cu. yd. Barrymore bodies on Mack chassis which are used for special purposes. These units are switched around to various plants as they are required, thus cutting down the amount of non-pay travel and idle time. A private telephone exchange connecting all of the plants and the main office makes this possible. All orders are taken at the Park Avenue plant office and relayed to the other plants. All of the gasoline for the trucks is received in tank cars at the Fyler Avenue plant and distributed to the other plants by tank truck. The fleet also includes a service truck for handling tires and supplies and the truck fitted with electric welding equipment which has been mentioned.

In addition to the usual tests of the concrete and aggregates made by city, state, and county inspectors, the company also makes its own tests to insure the quality of its product. There are laboratory facilities at each of the four plants, and a man is detailed to make regular tests at each of them. The chief testing engineer, who is in charge of all the laboratories, makes his headquarters at the Park Avenue plant.

The general offices of the company are at 605 Buder Bldg. The officers are: A. C. Butterworth, president; H. F. Thomson, vice-president; and K. W. Lick, general superintendent. Mr. Butterworth is an experienced railroad engineer and general contractor, and was a member of the former Miller-Butterworth Co. of Little Rock, Ark.

H. F. Thomson, vice president, has been an outstanding figure in the ready-mixed concrete industry almost from its beginning. He has written a number of articles and has addressed many conventions on this subject. When the National Ready-Mixed Concrete Assn. was formed on July 10 of this year he was elected western vice-president. He is also on two committees of the American Concrete Institute.

Mr. Lick has been connected with road and paving construction for many years, and for some time was an engineer with the Pennsylvania Highway Dept.

One of the papers presented by Mr. Thomson was "Water Control of a Commercial Central-Mixing Plant" which he read at the annual meeting of the American Concrete Institute at New Orleans last February. This paper describes in detail a water-measuring device which regulates the mixer feed and discharge in such a manner as to insure the highest possible quality and uniformity of product. It also eliminates any possibility of human error.

This device was developed by the General Material Co. organization and is now being used in all of the company's plants except Branch Street, which produces transit-mix only. The present device is the outgrowth of a series of successive installations. It consists of a closed pressure tank, adjustable for quantity, with the inflow and outflow of water controlled by separate valves connected

mechanically so that one valve closes completely before the other starts to open. The valve mechanism is connected with the batch-hopper gate in such a manner that the relative timing of the flow of water and material into the mixer may be adjusted. An interlock makes it impossible to shut off the water, once it has started flowing, until the measured quantity is in the mixer. This prevents the mixer operator from running the batches too wet as is often the case in most plants.

The device is very simple and does not require a skilled workman to operate it. One hand-wheel controls the entire cycle as it is turned through two revolutions, and it cannot be turned backward until the entire cycle is completed. Four things happen during this cycle in the following order: (1) inlet valve closes, (2) outlet valve opens, (3) hopper gate opens, (4) water discharge is completed. Some of the water enters the mixer before and some after the material enters. Reversing the hand-wheel then reverse the cycle of (3), (2), and (1). This equipment minimizes the physical effort required of the operator, and also eliminates possibility of error as the tank discharges only the quantity of water at which it is set and the operator does not have to watch a gage-glass. Exhaustive tests have shown accurate measurement of water to within one pint in 75 gal. Correct timing of the flow of water into the mixer is secured, which minimizes the amount of flushing and cleaning. The water used for washing out the mixers and trucks goes to a sump where it is clarified before going into the city sewers.

The company is a firm believer in the effectiveness of local advertising. An advertising wall sheet is distributed to all possible users of concrete in or near the city. This sheet shows a map of St. Louis and the strategic location of each plant.

Each of the company trucks has the company's trademark "Red-D-Mix" painted on the tail-gate, or on the side of the mixer-trucks. In addition the trucks carry removable signs on the sides giving various slogans, which are changed from time to time. Some of the slogans are: "Red-D-Mix Concrete—a better building material—faster work, greater strength;" "This load of Red-D-Mix Concrete going to a satisfied customer;" "Concrete for permanence, Red-D-Mix for convenience."

Some Accident-Prevention Problems

(*Continued from page 36*)

and sincere, they would co-operate to the fullest. I am proud of that fact, that the men understood that we were sincere and wanted to do it for their benefit as well as our own. No mutual interests are really existent unless both sides are happy. There is nothing to be ashamed of as to the material benefit of the company to reduce accidents. It ought to be and certainly is; we don't try to conceal that from our men or take it away from them. That is one of the arguments we present, because with their attitude it makes them all the more anxious to do it.

"Also, we are equally sincere in saying that we don't want this and that man—most of whom we know by their first names—hurt. And we would rather work along that line of thought. We make them understand that there are safe and unsafe ways of doing things, and that we are vitally interested in their method of working safe, but also interested in trying to so arrange the plant and its equipment that it will be a safe place in which to work and live, and to a reasonable extent they have met us along that line."

There are many possible causes of accidents in rock-crushing operations. One large company has reported that about 5 per cent of their accidents for a particular year were due to drilling and blasting. In the total, about 15 per cent of their injuries resulted from machinery. The rest of their accidents for the year they attributed directly to "carelessness." This company at that time was following the unique plan of assessing a fine of 25 cents against every man at work in a group when a member of that group was injured. This fund was used to defray the expenses of an annual safety banquet. The company agreed to defray all deficiencies of expense not provided by this fund, and thus the men were quite keen to keep their own "injury contribution" as small as possible. After many trials, this company was at last able to achieve a "no-accident month"; and they were also able to continue for nearly four additional months without an accident. Following the single accident that spoiled their record, they were able to go for an additional 150 days without a lost-time accident.

One large concern, The Texas Pacific Coal & Oil Co. (and affiliated companies), has issued to its general safety committee a hand-book called "Hazard Analysis and Safety Suggestions for Rock Crushing and Brick Manufacturing."

On the outside cover is this motto—"Safety Is the Best Insurance." It is announced in the "foreword" that "This company is deeply interested in the welfare of its employees and has used and will continue to use every effort in the promotion of safety. This alone is not sufficient, as statistics show that at least 75 per cent of all industrial accidents are caused by carelessness. We must have your help to make the work a success. . . . . Every suggestion and warning given in this pamphlet has been prompted by an accident which has occurred in the past. These suggestions are a direct appeal to you. Profit by the other fellow's experience."

As an example of the many safety suggestions in this booklet, the following are for "Rock Crusher Trainmen":

1. Be sure that engine and cab are clear of shovel during loading process.
2. Report any defects in condition of track and have them repaired.
3. Watch out for car dumper when bringing load into crusher.
4. Sound whistle when going around curve or if track ahead is not clear.
5. Watch out for men working on track. They sometimes can't hear your signal.
6. Use care in lighting boiler. Protect yourself from possible flareback.
7. Don't put injector in or open blow-off valve unless you know there is no one nearby.

Non-Metallic Minerals Important Factor in Canada's Future Development*

By M. F. GOUDGE
Department of Mines, Ottawa, Can.

NON-METALLIC minerals are indispensable to most manufacturing industries. In fact, the industrial prosperity of any nation is largely dependent upon widespread resources of these important minerals. The necessity of coal and petroleum as sources of heat and power is apparent. The ceramic industry manufactures its wide range of useful articles almost wholly from non-metallic minerals; so too does the glass industry. Structural industries utilize principally non-metallic products such as cement, lime, gypsum, stone, sand, and gravel. The pulp and paper industry requires limestone, lime, sodium salts, and non-metallic fillers. The importance of common salt to the fishing and chemical industries and its necessity in foods do not require comment. Minerals used in the chemical industries are largely non-metallic. In the metallurgical industries, limestone, silica, and fluorspar are indispensable as fluxes; and magnesite, bauxite, soapstone, fireclay, graphite, and silica are the more important of the equally necessary refractory materials. In the rubber, paint, textile, tanning, and other industries, non-metallics find important applications, and the list could be extended almost indefinitely.

Canada is fortunate in its variety and abundance of non-metallic resources, which include most of the more widely used minerals—bauxite being a notable exception—and a great number of the more uncommon minerals such as lithium minerals, actinolite, uraninite, and so on. Furthermore, these resources, with the exception of coal, are well distributed both with respect to the present centers of population and to the needs of the future; also, they are served by efficient transportation systems. In most areas, cheap power, hydro-electric or steam, is available. All these are factors of importance in considering future development.

In 1929 the total mineral production of Canada, according to the official estimate of the Dominion Bureau of Statistics on March 1, 1930 (all production figures given in this paper are based on estimates and subject to revision), was valued at $307,146,494, to which the non-metallic contributed $153,452,191, or slightly under 50 per cent. These figures, impressive though they may be, represent merely the current utilization of the non-metallic mineral resources. They present no adequate picture of the resources available for utilization should the demand arise.

Asbestos to the amount of 306,055 tons, valued at $13,172,581, was produced in Canada during 1929. This, a new high record both for tonnage and value, represents about 70 per cent of the world production in tons. However, 92 per cent of this is of non-spinning grades. All of the Canadian asbestos is obtained from the eastern townships in the Province of Quebec, where six companies are engaged in production. The belt of asbestos-bearing rock extends for over 100 miles from Lake Memphremagog, on the International Boundary, to East Broughton, 60 miles south of Quebec City; but present production is confined to two areas, the principal one 26 miles long, centering at Thetford Mines, on the Quebec Central Railway, and the other near Danville, on the Canadian National Railways.

The asbestos is of the variety known as chrysotile which, for general purposes, is considered superior to all other varieties. It occurs either as veins or as slip-fiber within a great mass of serpentine rock, and is won by open-pit mining. The great proportion of fiber is less than ¾ in. long, and only rarely is 3-in. fiber obtained. All fiber over ¾ in. long is cobbed out by hand and designated as "crude"; this, forming only 1.5 per cent of the tonnage, accounts for more than 11 per cent of the total value. The remainder is freed from the rock by crushing in successive stages. At each stage all freed fiber is removed by air suction. After the fiber is cleaned of dust and separated into different lengths it is ready for manufacture into the numerous asbestos products.

A large proportion of the asbestos is shipped in the raw state, principally to the United States and to Europe, but increasing quantities are being fabricated into various products in Canada. The products include building materials such as shingles, roofing papers, and asbestos boards; also brake linings, clutch facings, high-temperature insulation products, and asbestos packing.

Other promising deposits of chrysotile asbestos occur in Deloro and Bannockburn townships, Ontario, but no production has so far been recorded from these deposits.

Gypsum

As a producer of gypsum, Canada stands third among the countries of the world. The widespread distribution of the mineral in this country affords ample opportunity for increased production. At present gypsum is quarried or mined in Nova Scotia, New Brunswick, southern Ontario, Manitoba, and southern British Columbia. Large deposits as yet unworked occur in these provinces and also in the Magdalen Islands, northern Alberta, the North West Territories, and on some of the Arctic islands.

The high grade of the gypsum, coupled with the extensive deposits on tidewater in the Maritime

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Provinces, has resulted in an extensive export trade being developed, principally with the United States, and three-quarters of the Canadian production of crude gypsum is exported each year. Total production for 1928 was 1,246,368 tons, valued at $3,743,-648. Estimated production for 1929 was 1,211,383 tons, valued at $3,338,859. The increase in the utilization of this important structural material has been marked in recent years. Production for 1929 was almost double that of 1924.

Plants engaged in the manufacture of gypsum products are situated in Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, and British Columbia. The chief products are calcined gypsum, wallboard, and gypsum blocks. As plaster of paris, it is used in making molds and casts for various purposes. Raw or crude gypsum is used principally as a retarder in portland cement, as land plaster, and in the production of terra alba, used in the paper, paint, and textile industries.

Salt

Rock salt occurs in Nova Scotia, New Brunswick, Ontario, and Alberta. Brine springs are known in Manitoba, Saskatchewan, and in the provinces previously mentioned. At Malagash, Nova Scotia, the only salt mine in Canada is worked in a deposit which comes to within 10 ft. of the surface. Parts of this deposit are pure, and the material needs only crushing and screening before being marketed as coarse salt. A large part of the output from Malagash is used in the fishing industry and, for this purpose, has been found superior to the salt obtained from sea water. About 30,000 tons was mined in 1929.

In southern and southwestern Ontario, salt brine is obtained from wells drilled into thick beds of rock salt, which lie from 1,000 to 2,000 ft. beneath the surface. Crystal salt for domestic and other uses is obtained by recrystallization from the brine, and large quantities of the brine itself are used in the chemical plants of the district. A small production of salt has been made at various times from brine springs in Manitoba, Saskatchewan, and Alberta. Rock salt was encountered in Alberta at a depth of 631 ft. during drilling operations in 1920 at McMurray.

The salt industry in Canada has shown a steady growth. Production in 1929, 330,264 tons, valued at $1,578,086, is the highest on record.

The uses of salt, aside from its indispensable function in the seasoning and preserving of foods, are largely in the chemical field, where it is an important raw material entering into the manufacture of hydrochloric acid and various sodium compounds. Quantities are also used for refrigeration, in ceramic glazes, and in some non-ferrous metallurgical processes.

Limestone

Limestone occupies an important place among the mineral resources of Canada, and there is available within the Dominion a variety of limestone for practically every use to which limestone is put. In 1929, according to estimates, about 12,000,000 tons of limestone was quarried which, when made into the primary products, such as lime, cement, and stone for various purposes, had an initial selling value of $33,000,000.

The resources of limestone are well distributed with respect to present and prospective consuming centers. Deposits of pure high-calcium limestone are worked in every province except Prince Edward Island and Saskatchewan. Dolomite and magnesian limestone are produced in Nova Scotia, New Brunswick, Ontario, and Manitoba, and deposits of pure dolomite are available, but not at present worked, in Alberta and British Columbia.

Limestone for flux and for use in paper mills and in a great variety of chemical industries is being quarried in increasing amounts each year.

The Canadian lime industry has, during each of the last five years, established a new high record of production. The estimated lime production for 1929 was 590,174 tons, valued at $5,288,351. At present about 65 per cent of the lime produced in Canada is consumed by chemical industries. Owing to the steady expansion of the present chemical industries and to the prospects for the establishing of new industries requiring lime in their processes, the prospects of the lime industry in Canada are decidedly promising.

Cement

The portland-cement industry in Canada has been showing an almost steady increase in production since 1921, culminating in a record production of 12,284,081 bbl., valued at $19,339,244, in 1929. Cement plants are operated in Quebec, Ontario, Manitoba, Alberta, and British Columbia. The wet process of cement making has found increasing favor of late years, and several Canadian plants have been re-designed to use this process.

Sand and Gravel

Sand and gravel are seldom included in a discussion of the mineral resources of a country, yet they are of great value in the construction of highways, railways, and as aggregate in concrete. Both sand and gravel are available in quantity in every Canadian province except Prince Edward Island. It is estimated that 28,102,917 tons of these materials, valued at $5,809,431, was used in Canada in 1929.

Molding sands of various types are much more plentiful in the Dominion than is generally known, and domestic requirements could doubtless be supplied from these deposits.

Silica

Silica, in the form of silica sand, sandstone, quartzite, and quartz, is a non-metallic mineral of wide distribution in Canada. It has an important field of usefulness in the manufacture of glass, ferrosilicon, silica bricks, and as flux. Smaller amounts of finely pulverized silica are used in the paint and ceramic industries. The greater part of the Canadian production of silica is in the Eastern Provinces, principally from deposits of quartzite and sandstone. Quartz is produced also in conjunction with feldspar quarrying. Very little Canadian silica is

utilized in the domestic glass industry, in large measure because of competition from Belgian glass sand. In 1929, an estimated total of 280,000 tons of silica, valued at $500,000, was produced in the provinces of Nova Scotia, Quebec, Ontario, Manitoba, and British Columbia.

Feldspar

Feldspar deposits are of common occurrence in the areas of Pre-Cambrian rock throughout Canada, but production is confined to the provinces of Ontario and Quebec. The potash variety is the only type mined. Some of the deposits are a considerable distance from railway transportation; but, owing to the high quality of the feldspar produced, prices are such as to make operations profitable. In 1929, estimated production was 37,353 tons, valued at $343,-149. By far the greater part of the Canadian production is exported in the crude form to the United States. Grinding plants, capable of producing a finely ground spar, suitable for use in ceramic industries, are at Toronto and at Kingston, Ont. Recently, a bottle-glass plant has been erected at Oshawa, Ont., which uses feldspar as the principal raw material.

Mica

Closely associated with feldspar in occurrence is mica. This mineral too, occurs in the Pre-Cambrian rock in many parts of Canada, but the only producing localities are in Ontario and Quebec. The variety of mica produced is amber mica, or phlogopite, and Canada is the largest producer of this variety. Deposits of white mica and of black mica are also known. Estimated production in 1929 was 4,000 ton, valued at $120,000, the major part of which was from three or four properties. The deposit of mica at Sydenham, Ont., is one of the largest in the world. Production of both mica and feldspar could be greatly increased should the demand arise. The mica as mined is shipped to trimming plants, where it is prepared for domestic consumption or for export to Great Britain and the United States. Almost all the Canadian mica is consumed by the industries manufacturing electrical equipment. For this purpose, scrap mica is principally required. This part of the output is much more easily disposed of at a satisfactory price than is the sheet mica.

Graphite

Graphite occurs widely distributed in Canada. Production has been made from such widely separated points as Nova Scotia, Ontario, Quebec, Baffin Island, in the Arctic, and British Columbia. Present production is from Ontario and Quebec. Flake graphite is the only product. The total production of graphite in Canada for 1929 was 1,461 tons, valued at $103,174. Almost all of this was exported. Present market conditions are none too good, owing to the competition of the much more cheaply obtained graphite from Madagascar and also to the falling off in demand for graphite crucibles. Formerly, from one-half to three-fourths of the graphite production was consumed in the manufacture of crucibles. Foundry facings, lubricants, pencils, paints and stone polishes comprise the other main uses. Artificial graphite, made in electric furnaces, also produced in Canada, competes with natural graphite.

Magnesite

Production of magnesite in Canada is entirely from the Grenville district, Argenteuil County, Que. The Grenville magnesite deposits, which are crystalline in character, occur as replacement bodies in Pre-Cambrian dolomite. The entire production is dead-burned magnesite for use as a refractory material, principally in steel plants. Production during 1929 was 18,701 ton, valued at $491,170. Earthy hydromagnesite occurs in British Columbia. Deposits of this material near Atlin were operated during 1915 and 1916, but have not been worked since the last-named year.

Talc and Soapstone

Talc and soapstone deposits have been worked in Nova Scotia, Quebec, Ontario, and British Columbia. The present Canadian talc-mining industry is centered at Madoc, Hastings County, Ont., where two mines and mills are in operation. The talc, which is exceptionally high grade, occurs as lenses in a dolomitic limestone. Soapstone blocks are produced at Eagle Lake, near Vermilion Bay station, on the C. P. R. (Kenora district), Ontario, and also from Robertsville, Megantic County, in the eastern townships of Quebec. The blocks are used in sulphate-pulp mills to line the soda-ash smelting furnaces. Soapstone, also used where an acid-resisting material is required, has many applications in the manufacture of electrical appliances.

Talc has a great variety of uses, but most of the production is consumed as a filler in paper and paint manufacture, and as a surfacing material in asphalt roofing paper. The greater part of the Canadian talc production is exported after grinding. The estimated value of production of talc and soapstone in 1929 was $229,208.

Abrasives

Natural abrasives, including corundum, garnet, and sandstone, are available in many localities in Canada. No production of corundum or garnet is now being made, but the former mineral is available in quantity at Craigmont, Ont., where it was formerly mined. Garnets are found in a great many places throughout the Dominion, but production has been confined to one deposit near Bancroft, Ont. Development work has recently been done on two garnet properties in Quebec, but no production is recorded.

Sandstones suitable for manufacture into pulpstones, grindstones, and scythestones are found in New Brunswick, Nova Scotia, Quebec, Ontario, and British Columbia, but continuous production of these articles is maintained only in New Brunswick, where the 1929 production amounted to 1,248 tons, valued at $48,389.

Artificial abrasives have greatly cut into the market for all the above-mentioned natural abrasives

(*Continued on page 50*)

Survey Shows Fear of Sustained Period of Depression Not Justified

Progressive Management and Close Study of Fundamentals Aiding Industrial Ills

ANSWERING pessimistic reports being generally circulated on depressed business conditions and the causes thereof, more than 200 engineers specializing in management, manufacturing and merchandising work in industrial organizations throughout the country declare that the foundation of American business is sound and fears of a sustained period of depression are not justified.

The engineers, after months of investigation, emphasize that existing difficulties in industry can be attributed to shortcomings in management and lack of understanding of fundamentals that control the entire economic system of the country, with a failure to apply remedial measures to offset the mounting economic conflicts and difficulties that have arisen.

This report has been made by John F. Sherman, chairman of the board of The Sherman Corp., Boston, Mass., on the basis of surveys made by his engineering associates in every representative field of business activity. The engineers have studied every angle of industrial activity, from the production of raw materials, through all the processes of manufacturing and distribution, to retailing and consumer demand.

Industry Basically Sound

The consensus of opinion of the engineers is that the foundations of industry are sound, and the great need of business is to study the underlying causes of the present depression and to correct them by progressive principles of management based upon research in individual industries.

"Business is what you make it," is the key-note of the engineering report made by Mr. Sherman. "This applies to every line of industrial activity and reflects actual conditions as found in the analysis of business conditions by his engineers. The call today, more than ever before, is for specialization in industry to cope with every difficulty that has developed in every branch of our industrial life. In hundreds of business enterprises, executives have realized that special problems of management, manufacturing and merchandising call for special analysis and treatment."

The observations in this report represent, not a single group of industries, but the entire business structure of the nation—the aggregate analysis of economic conditions as a whole. The extensive survey reveals that there are no basic conditions undermining industry, and prophesies that the current depression will pass with the correction of existing defects in industrial procedures. The engineers are fully convinced that, by adequate measures of rehabilitation based upon research, normal business will be restored in a short while and the lessons learned will be of permanent value in industrial management.

Opposes Pessimism

Mr. Sherman takes a firm stand against the prevailing pessimism. According to all reports of his engineers, he states, conditions are not nearly so serious as they have been represented to be. He points out that the calls from leaders of industries for specialized engineering analysis and assistance proves that leaders of business realize the growing need of research and engineering principles in reaching a solution of economic problems.

"The financial condition of the country," he reports, "is unquestionably sound, and gold reserves are plentiful. We are a strong creditor nation and our exports continue to exceed our imports. The new tariff momentarily has had a psychological effect, but the flexibility of its structure will avoid any serious consequences. Retail sales are only 3 per cent under the peak year. In fact, in terms of items sold, they probably exceed those of last year, after giving effect to the reduction in retail prices.

"There is a minimum of surplus stock on hand, excepting for a few raw materials such as sugar, cotton and wheat. Natural laws and developments will care for their consumption within a reasonable time. Save for the excesses of such few raw commodities and the low prices which they consequently bring, there are none of the evidences present which make for panic or a long period of business depression. A recession of two years' progress is no cause for alarm.

"There are 120,000,000 people in the United States to feed, clothe and house, and our domestic market, plus our foreign markets, will meet our productive capacity, provided the management of industry looks the situation squarely in the face and applies remedies to cure existing industrial ills.

Employment Nearly Normal

"The employment capacity is given at 95 per cent of normal. A drop of 5 per cent in employment is not serious enough to affect the economic structure of the country or its people. Employment curtailment has been conducted in a more scientific and less injurious manner than in previous times. Hours of work have been reduced, and lay-offs have been staggered instead of the earlier method of wage cutting. So there have not been any serious consequences due to unemployment.

"An analysis of reports of business conditions yields no cause for alarm. Reported average corporation earnings are on a par with 1928. Statements of corporations, in the main, show that their current earnings are sufficient to cover their dividend

requirements. Accumulated surpluses are generally large.

"Even stock market prices, with all the harrowing cries of panic, are no lower today than they were in 1928. Money rates are low. Banks are growing more liberal in their industrial loans and, in consequence, expansion is possible for a great number of industries.

"An indication of the sound condition of the country is the growth of savings accounts, an unfailing barometer of progress. There has been a steady increase in deposits in savings banks, a recent report giving the amount of such deposits in the country as $29,000,000,000—a sufficient surplus to draw on in continuing to satisfy consumer needs and habits.

"It is axiomatic that consumption does not drop off in times of depression as rapidly as does production, and, conversely, production lags in resumption considerably after consumption increases. This soon results in a shortage.

"Food, clothing, housing and recreational facilities must be provided for the 120,000,000 people in the United States. Our domestic and foreign markets continue to grow, and the demand for our products will increase in accordance with the solution of existing problems through the most advanced principles of management."

Urges Trade Stimulation

Most of the contributing factors in the American industrial field today are encouraging, according to Mr. Sherman. Advertising should be continued as a means for stimulating and encouraging trade. The more progressive companies are making plans for increased advertising. The industries that improve their merchandising methods and adjust their operating conditions along more efficient lines will continue to forge ahead.

Business leaders today realize that research and scientific principles of management are all-important in keeping business on the upgrade. Over $200,000,000 annually is being spent in industrial research which promises to develop new industries to take up the slack caused by labor excess, resulting from mechanical labor-saving devices.

"The present period," Mr. Sherman declares, "offers an extraordinary opportunity for aggressive organizations with foresight and courage to outdistance their competitors. The executives who give careful thought to management and proceed with optimism will win over those who cling to old methods and are pessimistic."

In his report, the engineering executive emphasizes many specific cases where industries, handicapped by growing difficulties, had been saved by the application of engineering principles based upon surveys that revealed the need of new and improved methods in management, manufacturing and merchandising. Countless cases of this kind with which he has dealt prove, he said, that the operations of industries show a loss usually where faulty principles of management have undermined the industrial structure.

Non-Metallic Minerals in Canada

(*Continued from page 48*)

with the exception of pulpstones. The demand for pulpstones is steadily increasing, but as yet Canada produces only about 5 per cent of the pulpstones used in Canadian mills.

Diatomite

Diatomite deposits occur in practically all parts of Canada. The present outlook for production of this material is brighter than ever before owing to a wider appreciation of its value as an insulating material, as a filtering medium, and for admixture with concrete. The 1929 production of about 500 tons was shared equally between two companies, one operating at New Annan, Nova Scotia, the other at Quesnel, B. C. The Quesnel deposits have a maximum thickness of 60 ft. and are the largest known in Canada. Production from the diatomite deposits at Digby, Nova Scotia, and at Martin Siding, in the Muskoka district of Ontario, is expected in 1930.

Volcanic Ash

Extensive deposits of volcanic dust, from 2 to 30 ft. thick, occur at several localities in Saskatchewan and British Columbia. The dust, yellow in color, is consolidated into soft strata, and has a content of 60 to 75 per cent silica. Near Swift Current, Sask., a large deposit has been worked for the last few years. The material is used in cleansers and scouring powders.

There are possibilities of marketing the volcanic dust for use as a road-surfacing material and as an admixture in concrete to increase its workability. Volcanic dust is also a mild bleaching agent. Recently it has been found that it has the property of adsorbing certain dyes from solution, and this opens up possibilities for the making of colored pigments. Preparations are being made by two companies to market the material for these various purposes.

About 300 tons of volcanic dust, valued at $6,000, was produced in 1929.

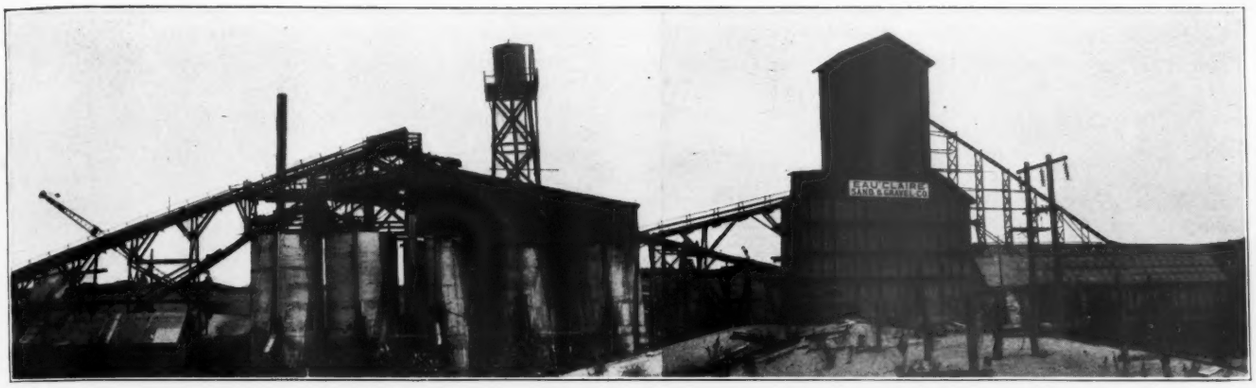
Bentonite, a peculiar clay-like material, occurs at several places in western Canada. Some of the deposits are 10 ft. thick. It is regarded as being possibly an alteration product of volcanic dust. It has many peculiar physical characteristics, which may ultimately render it a material of considerable value.

Actinolite

Actinolite is a mineral of which Canada is perhaps the sole world producer. It is exported to the United States, where it is used in the manufacture of roofing material. The maximum production of 550 tons was attained in 1902. In 1929 only 30 tons, valued at $375, was shipped. The deposits, in Hastings and Addington counties, in Ontario, are large, one being in the form of a lens a mile and a half long and 600 ft. wide. The actinolite is of the fibrous type.

Barite

Barite has been mined in Canada for upward of 60 years, but steady production has been maintained from only one deposit—that at Lake Ainslie, in Nova Scotia, and from there only in small quantity. Barite deposits have been worked at several other localities in Nova Scotia, Quebec and Ontario.



Plant No. 1, showing (left) washery, and (right), dry storage and screening. Boiler house is behind the silos.

Wisconsin Producer Operates Plants at Eau Claire and Chippewa Falls

Installation of Intraplant Transportation Plan Reduced Haulage Equipment 50 Per Cent

THE sand-and-gravel industry is well represented in the Badger State by the Eau Claire Sand & Gravel Co., which operates two plants, one at Eau Claire, Wis., producing red-flint sand for sand-blasting, filter sands and gravels; the other at Chippewa Falls, Wis., producing washed and screened aggregates for building construction.

Eau Claire Plant

Plant No. 1 at Eau Claire was built in 1918 as an ordinary sand and gravel plant. An addition was made to it in 1920 for the purpose of further refining the sand and producing special grades. The capacity of the plant is 60 tons per hour. The products made are engine sand, masons' sand, concrete sand, pea gravel, gravel, ¼-in. to 1½-in. concrete gravel, sand-blast sands, filter sands, and filter gravels. The deposits of sand and gravel include 111 acres of land owned by the company and about 60 acres of land under lease. The entire deposit and the plant are located within the city limits of Eau Claire, with shipping facilities over three railroads.

Pit material is excavated by a 3-cu. yd. power drag scraper of the company's own make. A Thomas, 2-speed, 100-hp. electric hoist is used to transfer the material to the plant field hopper which also was made by the company.

The material is fed from this hopper to a 20-in. field conveyor, made by the company, and thence to a Moorhead Machinery Co. scalping screen, the oversize passing to an Allis-Chalmers No. 2 McCully crusher. Material from the crusher joins the screened material in a 20-cu. yd. hopper, made by the company, whence it is fed to a Smith Engineering Works 20-in. inclined conveyor and is carried to the top of the plant. There it passes to a washer and to a Telsmith combined scrubber and screen 17 ft. long by 42 in. in diam., the screen being equipped with a sand jacket. At this point water is added to the material at the rate of 700 gal. per min., it being supplied by a Manistee Iron Works 6-in. centrifugal pump. The source of water is four 6-in. by 65-ft. drilled wells.

From the screens, sand and water are carried to a series of Richards classifiers made by Allis-Chalmers. Two or three sizes of sand are made and deposited in the concrete bins below. As is required, sand from the coarse classifier is diverted and sluiced to drain bins at the back of the plant where the water is drained off over a period of from twelve to twenty-four hours. The dewatered sand is then made to gravitate, through steam coil dryers, to a Smith Engineering Works 18-in. conveyor, delivered to the boot of an elevator, and elevated to a hopper at the top of the dry-screening

Disposal, by flume, of waste upon an island.

Train when discharging loads into the hopper.

Gravel storage at west end of No. 2 plant.

plant. The sand is fed from this hopper, at a uniform rate, to a battery of two W. S. Tyler Co. three-deck Hum-mer vibrating screens in series, i. e., one above the other.

For further refinement of sizes in the preparation of filter sands, several Orville-Simpson Co. Rotex screens are used on the floor below the Hum-mer screens. A long building at the extreme right of the dry screening building contains a series of bins for the additional storage of finished dry sizes of sand. The loading of dry sand into cars is accomplished by four flexible, metal spouts. The loading of cars from the additional storage is accomplished in an entirely different manner. Since material is available for loading from the ground-line up, it must necessarily be raised to a sufficient height for

Crushing plant and field conveyor, No. 1 plant.

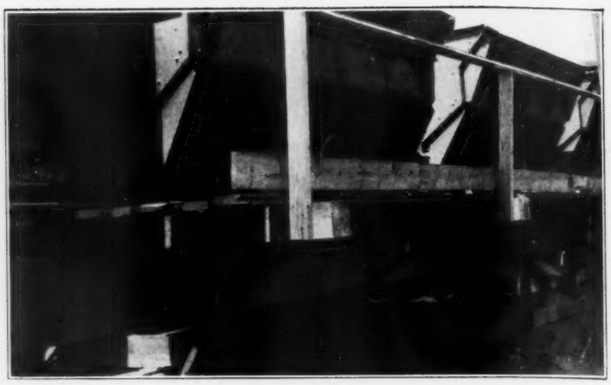
the loading of box cars, and this is done by the use of a portable elevator made by the company. This machine is fitted with a carriage having flange wheels and moves past the various gates and bins on a narrow-gauge track. It is operated by an electric motor installed on the chassis.

Other equipment in use at this plant includes a stiff-leg derrick having an 85-ft. boom powered by an American Hoist & Derrick Co. 3-drum, 37-hp. electric hoist, and a 1-cu. yd. Northwest Caterpillar crane. These machines are used for general storage and cleaning about the grounds.

Other buildings in the vicinity of the plant are the plant office building, tool house adjoining, and a garage.

Steam is supplied to the two dryer units by an

Plant No. 1 viewed from southwest.



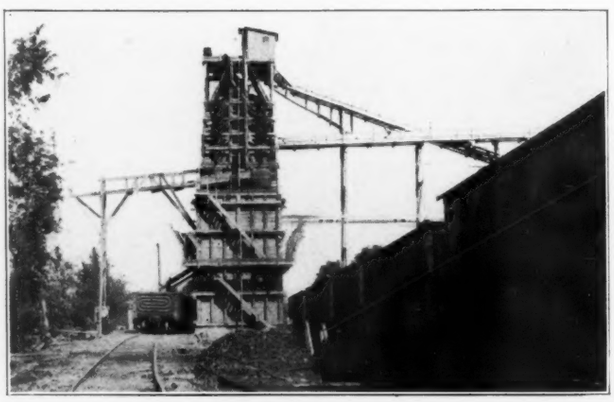
Self-dumping cars at 75-cu. yd. hopper.

80-hp. boiler fired by an Iron Fireman automatic stoker.

Chippewa Falls Plant

The construction of Plant No. 2 was completed in the spring of 1927 and is located on leased land having deposits of gravel extending over an area of from 150 to 200 acres. The capacity of the plant is 250 tons per hour. The plant is served by a spur track about 1.4 mile in length. The plant and deposit are located within the city limits of Chippewa Falls, Wis., and are served directly by two railroads with a nominal switching charge to a third. The prepared products are entirely for construction purposes and include three or four sizes of concrete gravel and three sizes of sand.

Pit material is excavated by a 3½-cu. yd. Moni-



End view of Plant No. 2.

ghan steam dragline excavator. It is loaded by this machine into three to five 7-cu. yd. Sanford-Day automatic, bottom-dump mine cars. The loaded train is then moved from the pit to a reinforced-concrete plant hopper—company's own make—by a Plymouth 8-ton gasoline locomotive on a standard-gauge track. Cars are equipped with Timken roller-bearing wheels. The material is discharged while the cars are in motion, by an automatic tripping device at the plant receiving hopper, and the discharge doors are closed automatically by a special device so that there is no loss of time. The hopper is covered by a rail grizzly with 6-in. spacing. The train comes to a stop when it has passed beyond the hopper and immediately reverses direction, returning to the

loading faces. The receiving hopper is constructed large enough to contain 70 cu. yd. of pit-run material.

The pit-run material is fed from this hopper to a 30-in. Smith conveyor and is elevated to the top of the plant, where it is divided and, with the addition of water at the rate of 1,700 gal. per min., passes through two lines, each having four Gilbert improved-type, conical screens. The several sizes of gravel produced here are deposited in bins below. Sand and water are flumed to four Link-Belt settling tanks for the purpose of producing the several sizes of washed concrete and mason's sands. The silt and waste sands rejected from these tanks are carried away from the plant by a long trestle.

Plant No. 2 viewed from south.

For preparing additional sizes of pea gravel and sand that are called for occasionally at this plant, a Simplicity vibrating screen was installed in 1929.

The entire plant is supported by heavy reinforced concrete substructures. The receiving hopper and the foundation for the No. 5K Gates crusher are constructed entirely of reinforced concrete. The loading of cars can be accomplished from either side of the plant. The entire plant and the surrounding grounds are well-lighted for the operation of night shifts. All parts of the plant are well-protected to avoid accidents.

Water is obtained from the Chippewa River and is pumped to the plant by two Allis-Chalmers 5-in., 850-gal.-per-min. centrifugal pumps. Each pump is direct-connected to a 45-hp. Allis-Chalmers squirrel-cage-type motor.

Automatic-dumping cars and 8-ton locomotive at Plant No. 2.

Office and tool-room at Plant No. 2.

A 25-ton Link-Belt locomotive crane is used for the purpose of switching cars and handling material to and from storage. An American, 7-ft. by 10-ft., 2-drum hoist serves for moving cars whenever the Link-Belt crane is being used for other purposes. This machine is housed in a small structure opposite the office building and below the level of the track grade. The cable for moving the cars passes from this hoist beneath the track and to a system of sheaves encircling the plant, making it possible to move cars in either direction and on either track.

A. O. Ayres, president of the company, refers to the intraplant transportation system at Plant No. 2 as follows:

"This plant, which was constructed in the early part of 1927, has several interesting features, one of the most outstanding of which is the type of car equipment used in transporting pit-run material to the plant. In 1928 the Sanford-Day Iron Works filled an order for three 7-cu. yd. automatic bottom-dump cars. In 1929 two additional cars of the same type were purchased. One train only is used, three to five cars being coupled together, depending on the length of haul.

"It has been found that the installation of these cars has reduced the pit haulage equipment by more than 50 per cent, making necessary only one train to haul a given yardage against the two trains when other types of cars were installed. In addition the low center of gravity and the roller-bearing wheels of the Sanford-Day cars reduce the investment in locomotive and operating charges."

A complete transformer station was built adjacent to the plant by the Northern States Power Co. for the supply of electrical energy. Other buildings about the plant include the plant office building and tool-room located on a level with the plant, and the blacksmith shop and oil-storage sheds on the hill.

In the operation of this deposit it is necessary to waste a considerable quantity of sand. Therefore, one of the most important features of the property is an island of approximately 43 acres, the general level of which is about 75 ft. below the point where waste material leaves the plant. This area is available for the disposal of this surplus waste material, and the operation is accomplished by gravity at a low expense.

The company has been in operation since 1919 with a constantly increasing volume of business.

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No-Accident Month in Cement Plants Is Improvement Over Last Year

June Campaign Gratifying in That No Fatal Accidents Occurred During Drive

APPARENTLY complete reports from Portland Cement Association member plants participating in the June, 1930, no-accident campaign indicate a total of 38 lost-time accidents. There were no fatal accidents during the month.

This record betters, by a margin of three fatal accidents, the results obtained in the 1929 no-accident campaign. Final reports for June, 1929, showed 38 lost-time and 3 fatal accidents.

The 38 accidents reported occurred in 23 plants. Of this number, 18 plants suffered just one lost-time accident each; six plants suffered two lost-time accidents each, while one plant suffered eight lost-time accidents. The accidents were distributed among the various departments as follows: quarry, 12; raw mill, 4; burning, 3; finishing, 3; crushing, 2; packing and shipping, 1; power, 1, and yard, 1. Eleven additional accidents occurred which are not yet possible to distribute by department.

Absence of fatal accidents during June recalls the gratifying recession in fatal-accident rate during the first six months of 1930. During the period from January 1 to June 30, only 7 fatalities were reported, as against 17 reported during the corresponding period of 1929.

While the total number of lost-time and fatal accidents reported for the first half of 1930 is approximately equal to those for the first half of 1929, there were fewer days lost. For the first time in recent years the improvement seems to have shifted from accident-frequency to accident-severity. By reason of fewer fatalities, fewer disabilities and less loss of time, the record is ahead of last year's severity rating to the extent of 75,000 to 80,000 days.

June accidents for which regular reports have been received by the association were as follows:

Quarry—(1) Brakeman on a quarry train slipped from the drawbar on which he was standing, crushing his foot.

(2) A laborer was struck in the mouth by a fragment of flying rock from a blast. His mouth was severely cut and a tooth was broken out.

(3) An air-line to a rock-drill broke, whipping the driller's legs, badly bruising and otherwise injuring the members.

(4) A large fragment of stone fell from a car, striking a laborer on the head. The man was stunned and suffered head bruises. Time lost, 8 days.

(5) Box-car at the quarry jumped a track. The brakeman, who was riding the car, was thrown off, landing on his head. Head, shoulders and back of the man were injured, a bad cut being inflicted on the right side of the head.

(6) A laborer sprained his right hand while lifting ties.

(7) Brakeman on a dump-car missed his step and went down, a wheel of the car passing over his foot, which was badly crushed, five bones being broken or mashed.

(8) A laborer working as an extra switchman tripped and fell as he reached a string of cars, a wheel probably passing over a part of hand. The injury included compound fracture of the thumb, lacerated palm and injuries of unknown extent to two fingers.

(9) A powderman at work springing holes was reloading for another when the powder exploded. His forearm was severely lacerated. He also suffered a wound near the right eye, a severely-bruised left hand, and cuts and abrasions over his entire body.

(10) Driller was barring down rock when a piece rolled and struck him on the leg, causing a large and possibly dangerous puncture wound.

(11) Drag-line fireman was pulling a chock from under a loaded gondola car. The chock caught his glove and pulled his arm under the moving car, severing the arm just below the elbow.

(12) A brakeman was caught between a locomotive and car, suffering severe crushing of the left thigh, as well as laceration of the muscles.

Crushing—(1) Rock from a pile fell on a laborer's foot causing a bad bruise.

(2) Crusher foreman hurt his back while lifting the end-gate of a gondola car to put it back in place. Five days lost.

Raw Mill—(1) Employee was helping to replace a door on a rock dryer when his foot slipped into some hot dust. The foot was burned and became infected.

(2) Laborer fell 8 feet to the ground from the top of a slurry-tank base, breaking two bones of his foot.

(3) While a laborer was endeavoring to take off a ring section from a pulverizer, the section fell, crushing two toes of his right foot.

(4) Laborer was cleaning up around a conveyor belt when his shovel became caught in the belt, throwing it around and striking him on the knee, badly bruising the bones and muscles.

Burning—(1) Repairman was on a ladder putting the belt on a clinker elevator when the ladder slipped, causing the victim to fall on an old pier. Hips were bruised, and his arm and hand injured.

(2) While an employee was working inside of a cooler some hot dust fell on his ear causing only a slight burn.

(*Continued on page 56*)

Government Board Prepares Tentative Specifications for Quicklime

THE Federal Specifications Board is adopting and promulgating specifications for various commercial commodities purchased by the various departments and establishments of the United States Government. These specifications, in the formative stage, are submitted to representative manufacturers for their comment and criticism, and the board is glad to receive comments or suggestions as to changes which may be thought desirable in the specifications.

The following items are selected and condensed from Specification No. 250, which deals specifically with quicklime.

Quicklime is of two types: type C, calcium; type M, magnesium. It must be well burned from a good quality of limestone, dolomite, marble, or shells. It must be reasonably free from ashes, core, overburned lime, or deleterious foreign matter. Type C quicklime must contain not less than 75 per cent calcium-oxide, while type M must contain not less than 20 per cent magnesium-oxide.

Quicklime must conform to the following composition, calculated to the non-volatile basis:

	Per cent
Calcium and magnesium oxides, minimum....	95
Silicon, aluminum and iron oxides, maximum..	5
Carbon dioxide, maximum:	
If sample is taken at the kiln.....	3
If sample is taken elsewhere.....	10

Quicklime must not contain more than 3 per cent, by weight, of waste.

Sampling and Inspection

In sampling bulk lime, 10 shovelfuls (not less than 100 lb.) shall be selected from different parts of the car by an inspector. This shall be broken, if necessary, so that it will all pass a 1-in. ring. It shall be mixed and quartered to obtain a final sample of 15 lb. This shall be divided into three equal parts and each part shall be sealed in an air-tight container. In sampling lime in barrels, 2 per cent of the number of containers (but never less than five barrels) shall be opened and their contents dumped in a pile. This pile shall then be sampled as for bulk lime.

Sampling shall be done as expeditiously as possible, to avoid undue exposure of the material to the air. One of the triplicate samples shall be sent to the consignor, one to the consignee, and the third shall be held for retest in case of dispute. Samples shall not be taken from broken packages.

Remove one-quarter of the sample as received, taking precautions to insure that the quarter is representative of the whole sample. Reserve the remaining three-quarters for the waste determination. Crush the quarter removed, so that it will all pass a No. 8 sieve, mix thoroughly and quarter. Crush this quarter so that it will all pass a No. 20 sieve, mix thoroughly and quarter. Crush all of this last quarter so that it will all pass a No. 100 sieve, mix thoroughly and place in an air-tight container until analyzed.

Chemical Analyses

Weigh out 0.5 g. of the material and transfer to a platinum or porcelain evaporating dish. Mix to a thin slurry with distilled water, add 5 to 10 c.c. of HCl (sp. gr. 1.20) and digest with gentle heat and agitation until solution is complete. Evaporate this to dryness so far as this may be possible on the water bath.

Silica.—Heat the dish and its contents in a drying oven for one hour at 110 to 120 deg. C. Drench the cooled mass with 20 c.c. dilute HCl (1:1) and heat on the water bath for 10 min. Add an equal volume of water. Filter. Wash the residue thoroughly, first with dilute HCl and then twice with cold water. Evaporate the combined filtrates to dryness. Extract with HCl as before, filter through a second paper and wash as above. Save the filtrate. Place both filter papers and their contents in a platinum crucible and ignite to constant weight. Add 5 c.c. of HF and two drops of concentrated H_2SO_4 to the ignited residue. Evaporate to dryness, ignite for 2 to 3 min., cool and weigh again. Record the loss of weight as silica.

Iron and Aluminum Oxides.—Fuse the residue remaining in the platinum crucible after the HF treatment with 0.2 to 0.3 g. Na_2CO_3. Dissolve the cooled melt in HCl and add the solution to the filtrate obtained in the silica determination. Add a few drops of bromine water or HNO_3 and boil to remove excess of bromine or chlorine. Then add HCl, if necessary, to insure the presence of 10 c.c. of concentrated acid. Add a few drops of methyl red solution, dilute to 200 c.c. and boil. Nearly neutralize with concentrated NH_4OH. Complete the neutralization with dilute ammonia (1:3), adding it slowly until the color of the liquid just changes to a distinct yellow. Boil for one or two minutes, allow to settle, filter, and wash two or three times with a hot 2-per cent solution of NH_4Cl. Transfer the paper and precipitate to the beaker in which the precipitation was made. Add 10 c.c. concentrated HCl, macerate the paper, dilute to 200 c.c., boil, and reprecipitate with NH_4OH, as described above. Filter into the beaker containing the first filtrate and wash as previously described. Ignite the precipitate in a platinum crucible and weigh as oxides of iron and aluminum.

Calcium Oxide.—To the filtrate from the iron and aluminum determination add a few drops of NH_4OH and boil. Add 35 c.c. of a saturated solution of ammonium oxalate and continue the boiling until precipitated calcium oxalate assumes a granular form. Allow to stand 20 min. or until the supernatant liquid is clear. Filter and wash thoroughly with hot water. Ignite the precipitate in a platinum crucible. Dissolve in hot dilute HCl, and

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make up to 100 c.c. with water. Add a slight excess of NH_4OH and boil. If any aluminum-hydroxide separates out, filter, wash with 2-per cent NH_4Cl, ignite, weigh and add this weight to the oxides of iron and aluminum determined previously. Precipitate with ammonium oxalate as before. Filter, and combine the filtrates from the two filtrations. Ignite the precipitate to constant weight in a platinum crucible, and weigh as calcium oxide.

Magnesium Oxide.—Acidify the combined filtrates from the calcium precipitates with hydrochloric acid, concentrate on the steam bath to about 150 ml. and make slightly alkaline with ammonium hydroxide, boil and filter (to remove a little iron and aluminum, and perhaps calcium). When cool, acidify the solution with hydrochloric acid, add 10 ml. of saturated solution of sodium-ammonium-hydrogen-phosphate, and ammonia, drop by drop, with constant stirring. When the crystalline ammonium-magnesium-orthophosphate has formed, add 10 ml. of ammonia in excess. Set the solution aside overnight in a cool place, filter, and wash with water containing 2.5 per cent NH_3. Dissolve the precipitate in a small quantity of hot hydrochloric acid, dilute the solution to about 100 ml., add 1 ml. of a saturated solution of sodium-ammonium-hydrogen phosphate and ammonia, drop by drop, with constant stirring, until the precipitate is again formed as described above and the ammonia is in moderate excess. Allow the precipitate to stand about two hours; filter and wash as before. Place the paper and contents in a weighed platinum crucible, char the paper slowly, and carefully burn off the resulting carbon. Ignite the precipitate to constant weight over a Meeker burner, or a blast not strong enough to soften or melt the pyrophosphate. Multiply this weight by 0.3621 to find the weight of magnesium oxide.

Carbon dioxide.—Weigh out a 5-g. sample and transfer it to a small Erlenmeyer flask. Put this flask in a carbon-dioxide train composed as follows: After the flask comes an upwardly inclined condenser; then U-tubes containing $CaCl_2$, anhydrous $CuSO_4$, and $CaCl_2$; then a U-tube filled with porous soda lime; and finally a U-tube containing half soda-lime and half $CaCl_2$, arranged so that the $CaCl_2$ comes last. Pour some hot water on the sample, connect the flask to the train, and pass a current of CO_2-free air through all of the train excepting the two soda-lime tubes. Close, weigh, and attach the soda-lime tubes. Through a separatory funnel, let some 1:1 HCl into the flask slowly. When any apparent action has ceased, heat the flask gradually to boiling, and continue boiling until no more gas is evolved. Cool gradually. The current of CO_2-free air is continued throughout the experiment. Detach the soda-lime tubes, close, and let them stand in the balance case, weighing them at 30-minute intervals until two successive weighings agree within 0.5 mg. The gain in weight of the tubes is recorded as the weight of the CO_2.

Non-volatile matter.—Weigh out a 1-g. sample and ignite to constant weight in a platinum crucible. The weight of the material left is the weight of the non-volatile matter.

Calculations.—The weights in grams of the oxides of silicon, iron, aluminum, calcium and magnesium, as found above, are multiplied by 200 to reduce them to percentages. The weight of the carbon-dioxide in grams is multiplied by 20. All of these figures must then be divided by the weight of the non-volatile matter as found in the preceding paragraph to reduce them to the non-volatile basis called for in the table of requirements.

Waste Determination

After the sample for chemical analysis has been set aside, all of the rest of the sample as received shall be screened on a No. 3 sieve. Weigh the lime retained on the sieve and transfer it to a slaking box. This lime is then slaked by an experienced operator to produce the maximum quantity of putty, care being taken to avoid "burning" or "drowning" the lime. Cover the box to prevent evaporation and let stand 24 hr. Transfer the putty to a No. 20 sieve, and wash it through the sieve with a stream of water from a hose. This operation must be completed within 30 min. The sieve and the residue contained thereon are then dried to constant weight in a current of CO_2-free air at a temperature of 110 to 120 deg. C. The dry weight of this residue is divided by the weight of the lime slaked, multiplied by 100, and the result reported as "per cent waste."

Unless otherwise specified, commercial packages are acceptable under this specification. Quicklime may be delivered in bulk if in carload lots, otherwise it shall be delivered in barrels holding 180 or 280 lb. each.

No-Accident Month Improvement

(*Continued from page 54*)

(3) An employee was poking out the clinker housing from under a kiln and was burned about face, hands, feet and back.

Finishing—(1) Laborer was operating jackhammer drill when drill steel snapped off and machine fell. In trying to check fall, finger was jammed between top of broken drill and hammer. There was a slight fracture of little finger.

(2) Oiler was removing a panel from a finish-grinding mill. The panel slipped off the hook and fell to floor striking the injured on instep, fracturing two bones.

(3) While taking burning hose out through a window at the clinker mill, cement fell from overhead and into an employee's eyes. A loss of 3 days' time resulted.

Packing and Shipping—Packer, while stacking sacks in a car, strained his back when throwing out a broken sack.

Shops—A carpenter was helping to turn a piece of 4½-in. by 12-in. by 10-ft. oak timber on a saw carriage. The piece rolled off the carriage, striking him on the right foot, badly bruising the instep.

Yard—Laborer was standing by the roadside at a railroad crossing. As a tractor hauled a stone-boat across, the boat became caught on the track, swung toward the man, striking him on the leg causing a compound fracture.

Produces Diatomite by Modern Methods from Central Oregon Deposit

Atomite Corporation of Portland Took Over Property on 25-yr. Lease in 1927

By W. A. SCOTT

THE well-known diatomite property situated on the Deschutes River, seven miles from Terrebonne, Ore., was owned formerly by The Diatomite Co., controlled by J. W. Ganong. Early in 1927 it was acquired by the Atomite Corp. of Portland, Ore., under a 25-year lease. Since then the property has been further developed and operated under the guidance of Arthur Krieger, president and managing director. A change is now in process whereby the Atomite Corp. assumes ownership in lieu of the 25-year lease. Mr. Ganong, the former owner, is associated with Mr. Krieger as a director of this corporation.

This diatomaceous deposit is in blanket form, approximately one mile wide and one and one-half miles long. It is about 30 ft. thick at the north end and 65 ft. thick at the south end. It carries a 12-ft. overburden of sand and gravel which, in the course of development, is removed by power shovels and dump cars in order to expose the level surface of the deposit preparatory to quarrying operations.

The deposit occurs within a well-defined basin of a primary lava flow which came from either the Cascade range on the west or the John Day region on the east. The diatom growth began in a small fresh-water lake that lay upon a shelf of the original lava flow. When the second flow of lava occurred and spread over most of the original flow, the small lake basin escaped submergence. It is believed the cooling banks of the lava streams formed a rim near the margin of this pool, thus preventing the entrance of the secondary lava flow. Anyway, the lake with its diatom growth remained. But, at a later period, the lake basin was filled with a layer of rock and gravel by a torrent from the mountains, and this debris, in turn, was later covered with an alluvial deposit. Although the small basin remained, the lake of water disappeared through drainage and displacement.

Subsequently, the channel of the Deschutes River was formed, and it cut through the small basin that formerly held the lake upon the shelf of the original lava flow. Now, on the exposed slopes of this river canyon, are plainly visible the original lava, the later secondary flow, the diatomite deposit, and the sand and gravel overburden.

The diatoms here are classified as fresh-water species. They apparently extended their frustules to the bottom of the lake where, with no agitation of the water, they deposited without stratification. It appears that no extraneous material, such as clay and salts, had washed into the lake, the shore-line of which was lifeless. Therefore, the diatom shells, of depths ranging from 30 to 60 ft., were deposited

Deposit is exposed along cliffs eroded by the Deschutes River.

Ricks rest upon wooden racks. Note large lump held easily by the woman.

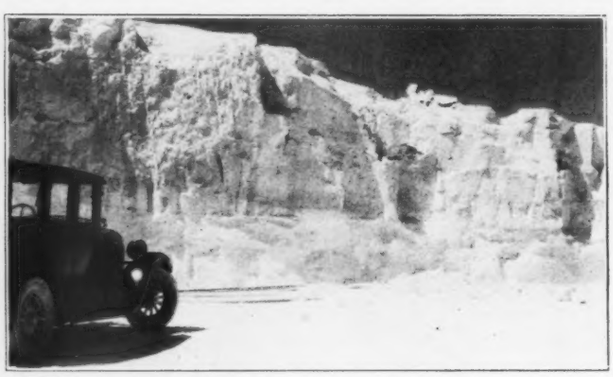
without the inflow of other elements to any extent.

The sand and gravel capping held the deposit intact. It was the cutting of the Deschutes through the ancient basin that revealed to man the diatomite bed underlying that gravel capping. The diatomite deposit is itself bordered by a rim of the secondary lava flow. Throughout the deposit, from its lava bedding to the gravel overburden, there appears no great deviation from uniformity as to weight and nature of diatoms. The variation in weight per cubic foot of the diatomite in place runs from 19 lb. to 26 lb. The heavier layers are more plastic than the lighter ones, although all layers are quite free from clay or other foreign material.

This diatomite, as revealed under the microscope, carries 97 to 99 per cent diatoms, either integral or fragmentary. In the company's exploratory work, by way of taking cross-sections and sinking test holes, no evidence of other prehistoric life has been found.

As said, this diatomite is a very light material. Its weight, after field drying, varies to some extent according to the different strata from which samples are taken. In its solid condition its weight is less than one-half the weight of the powdered material. The extreme lightness makes it desirable for those who utilize it in the various industries.

The diatom structure carries about 90 per cent silica, the other elements being water of crystallization and small amounts of magnesia, iron, and aluminum. The deposit, being of fresh-water origin, comprises silica which is quick to act in the presence of free lime, as in concrete, because it has not been previously in contact with lime or any salts.



Portion of 1,200-ft. face of pure diatomite, the deposit extending down 40 ft. below this floor.

In stripping the deposit of its 12-ft. overburden a Bucyrus No. 45 steam shovel with a ¾-cu. yd. bucket and a Universal standard gas shovel with a 1/3-cu. yd. dipper are utilized. Parallel cuts are made the full depth of the sand and gravel and about 1,200 ft. in length. The excavated material is loaded into Western 1-cu. yd. side-dump cars, 30-in. gauge, that run on movable tracks laid upon the stripped surface of the diatomite. Trains of those loaded cars, drawn by two Brooks 10-ton steam locomotives, are hauled a short distance to the brink of a canyon into which the material is dumped. However, in the near future, this system of track haulage of the overburden will be supplanted by truck haulage, for which two International 3-ton trucks with dump bodies will be used.

Quarrying and Drying

After long, longitudinal strips are thus cleared of sand and gravel the diatomite is quarried in benches that run from 6 ft. to 10 ft. in depth, 30 ft. to 100 ft. in width, and about 1,200 ft. in length. This work is performed by crews of two to three men each, using picks of a type suited to cutting and splitting the material into lumps averaging 1 cu. ft. in size. The cutting and splitting operations are aimed to produce a low percentage of small pieces. The regular lumps are loaded onto Skagit Iron Works flat-top cars, drawn on rails by two Fordson rebuilt tractors and hauled to the drying field. Here they are piled in ricks 3 ft. wide, 7 ft. high, and of the maximum length of 1,000 ft. Some of this field haulage is with horse-drawn wagons.

At the high elevation and in the dry atmosphere of this locality the material is sufficiently dried out in two to four weeks. The raw diatomite from the benches carries about 45 per cent moisture which, by air-drying in ricks, is reduced to 5 per cent. The chips resulting from quarrying are too small for drying in ricks. These have been accumulated in bulk and may be artificially dried. For this purpose there was installed a Ruggles 6-ft. by 60-ft. cylindrical dryer, equipped with a Murphy coal stoker. Thus far, this dryer has not been operated.

Ricks of diatomite, with mill in background.

Treatment in the Mill

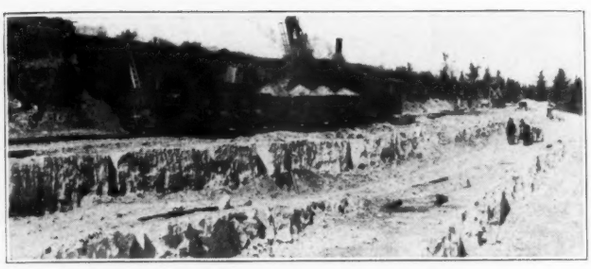
The original mill on the property, whose capacity was 50 tons per day of two 8-hour shifts, was destroyed by fire in February, 1930. A new mill, rated at 100 tons per day of three 8-hour shifts, was promptly built. The new plant has practically the same class of equipment as had the first one, but

with the addition of a Bates triplex packer, used for packing the product into both paper and burlap sacks.

The field-dried diatomite is hauled to the crushing, pulverizing, and grading mill situated at one end of the deposit. In this haulage the same equipment is used as for haulage to the ricks.

The material, on delivery at the mill, is dumped into bins from which it is fed, by gravity, into a spike-roll pre-crushing unit built by the Bend Iron Works, Bend, Ore., from designs of the Atomite Corp. Its product, of egg size and less, is transferred to storage bins by two Link-Belt bucket elevators 60-ft. high. The machines are belt-driven by 25-hp. motors.

The material is drawn from the storage bins to a set of Collins finishing mills of the hammer type, driven by a 50-hp. motor. The material is so reduced that 90 per cent will pass a 200-mesh screen.



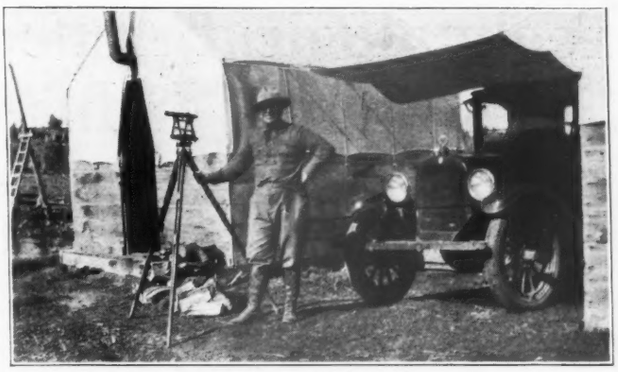
Stripping and loading overburden.

This is followed by a classification into grades by four motor-driven air separators of the cyclone type, developed and built in this company's shop. The coarsest grade obtained is returned to the Collins mills for regrinding. The finer finished product is put up mostly in burlap sacks of 100 lb. each for shipment. This material is of such a nature that it does not sift through the burlap while being handled and shipped.

The sacked products for the various consumers are delivered by motor trucks to the railroad at Terrebonne, where the Atomite Corp. has storage for 25 carloads. Storage is provided also at one of the river docks in Portland from which reshipments are made by water. The corporation's diatomite shipments for 1930, it is estimated, will be in excess of 10,000 tons. A carload of this product amounts to 25 tons, large furniture and automobile cars being used for making shipments.

The market for these products is both domestic and foreign. Its uses are in the filtration of sugar solutions, corn products, vegetable oils and varnishes, and in connection with other processes; also, for insulating purposes, and as an admixture to cement concrete.

An oil-burning calcining unit has been installed as an adjunct of the mill for calcining the raw diatomite to drive off all free water and to remove the possibility of shrinkage. The company's plans are to install successive units, each of about 10-ton daily capacity, as demands develop. This unit has four oil-burning furnaces, with a combustion chamber for each one. This calcining equipment was designed, built, and installed under the direction of the company's engineers.



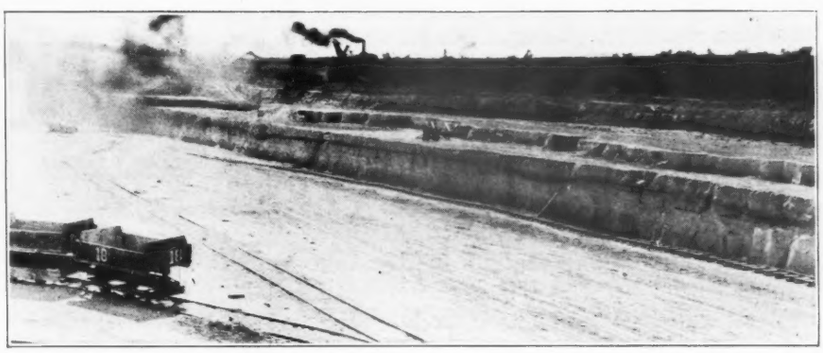
Willis H. Bartlett, plant superintendent.

Laboratory Well Equipped

In the laboratory are modern facilities for plant control and for both physical and chemical testing. All shipments are checked to rigid specifications, and are so controlled that they can be duplicated exactly at any future time. Important work of the staff is to control the blending of grades intended for different purposes. The laboratory work extends to microscopic technology for making determinations as to the characteristics of the diatomite taken from the several benches.

To Arthur Krieger, managing director of the Atomite Corp., belongs the credit of having developed and established the diatomite industry in California. It was he who organized the business and directed the operations of the Celite Products Co. in that state. He served as its managing director from its inception in 1912 to 1920.

The Atomite Corp.'s operations at Terrebonne are under the superintendency of Willis H. Bartlett, who also directs the laboratory and research work. Mr. Bartlett is a graduate of the School of Mines, Corvallis, Ore.



Showing several benches in the diatomite deposit.

Technological Aspects of the Soapstone Mining Industry in Virginia*

By C. W. RYAN

THIS paper contains a brief sketch of the geology of soapstone in the Piedmont section of Virginia, in the southern portion of Nelson County; also a description of methods of prospecting, developing quarries, quarrying and milling methods in that section. The paper is intended for those who have little information regarding soapstone; undoubtedly men of practical experience will find many points of criticism.

"Soapstone of the igneous metamorphic type is thought to be an alteration product resulting from the introduction of magnesia and the addition of upward rising carbon dioxide and water in a heated condition into basic igneous rock. The addition of these constituents has been accompanied by the removal of certain of the constituents of the original igneous rock. The altered rock consists almost entirely of new minerals, the chief of which are talc, antigorite, chlorite, amphibole, dolomite, and related products," says C. P. Berkey in an unpublished private report. The late Dr. Thomas L. Watson, state geologist of Virginia, describes the soapstone of this region as having been derived from an altered eruptive rock. Keith describes the deposits in Fairfax County, Va., as having been derived probably from the eruptive rocks peridotite and pyroxenite. There are various other theories as to the origin, but these are the most widely accepted and the evidence afforded by field and laboratory study very decidedly favors this explanation.

Soapstone is a mineral about which little is said in technical or trade journals. This lack of literature on the subject is due primarily to the comparative rarity of operations in this rock. However, there are numerous features of soapstone production that should prove of interest to those engaged in the other non-metallic mineral industries. The present installment of this comprehensive paper is concerned with geological and mineralogic matters.

The area in southern Nelson county under the observation of the writer may be described briefly as an intrusion of basic igneous rock, which has been identified as a peridotite, into the Cambrian schists of the region. The schists maintain, in general, a strike N. 40 deg. E. to N. 60 deg. E. and a dip of from 70 deg. to 80 deg. to the southeast. The peridotite dike in general has a strike parallel to that of the schists, although locally it may cut across the latter at a slight angle. Parallel to the peridotite and to the northwest of it is a vein of soapstone peculiarly different from those associated directly with the peridotite. The distance of this vein from the main intrusive dike varies from 150 to 250 feet. The main intrusion itself varies in width from ⅛ to ¼ mile.

The general arrangement of veins in the soapstone area (i.e., the area embracing the whole system of veins of soapstone, schist, and peridotite) is as follows. Beginning at the western border of the soapstone belt and advancing eastward, we encounter the footwall of the whole system—a quartz-biotite schist, which becomes altered by weathering to a golden phyllite. The schist is characterized by certain distinctive peculiarities. Its bedding is ordinarily quite regular, except for certain recurring areas containing small lenses and beds of green sandstone, which generally are not wider than 3 or 4 inches, though in exposures the mass of schist is pitted with cavities resulting from the solution and removal of pyrite crystals. An interesting though probably unimportant feature of the schist is a regular crinkling or waving along the planes of schistosity, which reminds one very much of the tiered arrangement of the leaves of a book lying open. Whether this crinkling was caused by pressure transverse to the planes of schistosity or is an evidence of original ripple marks in an old sediment is not clear. At the contact of the soapstone vein with the schist there is a thin bed of brown or black mica schist which at times is replaced by a green chloritic schist. The occurrence of this bed is not universal all along the vein but it is usually found as described. Next to the mica schist is the west vein of soapstone. It carries crystals of iron carbonate (siderite) in sizes varying from microscopic to ½ inch wide. These crystals affect the commercial value of the stone, too many having a tendency to make it worthless. The crystals occur in zones paralleling the dip and strike of the vein. The zones may be 30 to 50 ft. wide and separated from each other by areas of about the same width in which the iron carbonate does not occur. Next to this belt is a thin layer of brown mica, lying against a diorite dike which is about 20 ft. wide. This grades off into a fine-grained peridotite only a few feet thick, and this, in turn, gives place to a variety of soapstone very similar in texture and mineral character to the soapstone of the east vein. This zone is considerably fractured and shot through with mica at its contact with the peridotite. It continues through a width of about 145 feet in which distance

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it changes alternately from a good, green, comparatively hard stone to a very hard stone with small talc content and a generous sprinkling of small dark groups of crystals composed of tremolite and magnetite, which give the stone a mottled appearance. These crystal groups contribute largely to the hardness and grittiness of the stone. The alternate layers are never more than 50 ft. thick, the interchanging of grades becoming more frequent toward the center of the body. The layers of workable stone are widest near the diorite dike and become narrower to the eastward. This narrowness is accompanied by blockiness and an admixture of thin layers of brown and green mica. The layers of hard, gritty stone become wider and contain more of the dark crystal groups as the hanging wall of peridotite is approached. Toward the east the mass again is broken by layers of brown mica and occasionally by antigorite. The mass of hard soapstone finally grades off into the peridotite of the hanging wall. In some localities the hard gritty stone is not apparent, but is replaced by a very excellent grade of soapstone which is free of siderite and hard crystal groups of tremolite.

The peridotite that separates the middle vein from the east vein varies from a fine felsitic texture on the borders to a rather coarse granitoid texture in the central zone. Occasionally it is intruded longitudinally by a narrow dike of diorite or basic rock. In places there are evidences of small lenses of soapstone, not on the strike of the main bodies, but well within the intrusion and roughly parallel to them.

The middle vein is frequently lost altogether as a soapstone vein, although the portion of the intrusion that is altered to workable stone is always easy to recognize. There are a few physical evidences characteristic of this rock. The most outstanding is the presence of the siderite and siderite-forming minerals, which are everywhere apparent in the western half of the middle vein of soapstone. This rock can be located also by the crystalline schists that border it. Even where there is no outcrop of the schists their presence may be indicated by the characteristically sandy and micaceous soil overlying them, which is frequently broken by small veins of quartz. The best indicators of workable lenses of soapstone in the middle vein are the heavily talcose outcrops or, where the outcrops cannot be seen, the presence of float from the eroded vein. The float is easily sectile, as a rule is discolored by iron oxide, and is pitted with siderite cavities. The outcrop itself may be stained with iron oxide or it may be green and pitted with siderite cavities. Frequently the float is the main evidence, the outcrop being merely a narrow rib of stone, which sometimes is remarkably pure and stain-free.

Granitic Intrusions

The continuity of the peridotite is disturbed in some places by granitic intrusions of a different origin. At one point there is an intrusion of a rather acid igneous rock which borders the east edge of the peridotite. There is no evidence, however, that it actually intersects the basic intrusives. In one place northwest of Rucker's Run the writer has seen a granite dike which replaces the diorite of the west vein for quite a long distance. It is not known that this rock cuts the schists transversely, but it absorbs the west vein almost entirely and runs out into the schists for some distance, finally playing out at some distance from the normal line of contact. The granite grades into the schist at this place instead of forming an abrupt line of contact. The minerals of the intrusive are thickly scattered in the schist for some distance, gradually becoming more sparse until they disappear altogether. This would lead the observer to believe that they were injected in a gaseous form under considerable pressure.

Geological Deformation

There are indications that the whole mass of both intrusives and schists locally have been subjected to movement subsequent to the formation of the soapstone. The main considerations back of this assumption are few, but very apparent. There are local variations in the strike of both the intrusives and the schists, which are decidedly abrupt. These breaks are accompanied by weaknesses which have influenced the local stream channels to some extent. Another evidence of the movement is the broken and blocky nature of the soapstone and peridotites themselves in areas that under ordinary circumstances would be of great commercial value. The writer knows of two localities in good bodies of commercial stone that have been ruined by bending and shearing movement of this nature.

Origin of Virginia Soapstone

The writer's theories as to the origin of the soapstone deposits in the southern part of Nelson County are somewhat original, though it will be found by comparison that, in part, these theories are in line with the accepted explanation of these deposits. The writer feels that even though some of his arguments may be subjected to rather severe criticism, there may be something among them that will be of assistance to those more skilled in unraveling the mysteries of geological occurrence.

Theories of Origin

The most westerly portion of the west vein originated as a micaceous schist which was metamorphosed at some time prior to the intrusion of the main dike, and subsequently was further deformed by this intrusive action. The eastern half of the west vein is igneous and of the same origin as the main intrusion, which embraces both the middle and east veins. The mineralizing agents were derived from the intruded schists and were injected as aqueogaseous solutions into the matrix.

In analyzing the west vein, we suggest that the schistose variety of soapstone on the footwall is

the oldest of the three veins in the system. This vein had its origin as a micaceous schist which was impregnated with talcose minerals by upward-rising agueogaseous solutions under considerable pressure. The writer suggests that this was an entirely separate mineralization from that which formed the other veins. The vein was later subjected to the shearing action that gave it the gnarled appearance, and the movement causing this was contemporaneous with the intrusion of the adjacent peridotite. It was protected from the intrusives by the schist horse which lies between the two. The addition of pyrite came later, as it is found both in the veins and the schists of the hanging wall. The eastern half of this vein was probably mineralized at the same time as were the middle and east veins, the extent of the mineralization having been dependent on the extent of absorption of the mineralizers from the fragments of schist incorporated in the intrusive mass. As there is a universal tendency along the borders of the intrusion toward alteration and impregnation of the matrix with talc and other soapstone-forming minerals, it is reasonable to deduce that soapstone was formed in those localities in which a sufficient amount of material had been assimilated from the country rock to furnish the required percentage of the necessary minerals. It is not to be assumed that talc was assimilated, but rather that the magnesium silicates that could be altered to talc were absorbed.

As to the extent of alteration to which the various zones have been subjected in order to form soapstone, it is well to observe that, in general, the more coarsely textured stone are those which have been the more highly mineralized. This statement must necessarily be qualified by saying that it is true in the border portion where there has been a quantity of the mineralizing agents, or in the interior of the mass where there is local concentration of mineralizers. As the mineralizers were derived from the schists themselves, a greater amount and intensity of mineralization is naturally found in the border portion. Only locally has a large enough mass of schist been isolated within the interior of the intrusives to change the intrusive body to soapstone. On the immediate contact between the schists and the intrusives the peridotite was chilled too rapidly for the magnesium solutions to permeate its extremely fine structure, and they were forced upward into the more slowly cooling masses near by. It is illogical to assume that the gases would find their way far into the interior of the molten mass even in flatly dipping veins. They not only found an easier avenue of escape through the slowly crystallizing near-border portion than through the heavy molten interior, but they were all assimilated before they reached the molten portion.

The theory of the absorption and liberation of mineralizers as adopted by the writer is simple. The schists that were intruded were subjected to considerable movement, which resulted in the breaking off and crushing of quantities of these country rocks. These fragments were assimilated by the molten intrusives and the magnesium gases, together with many others, were liberated in large quantities to find their way up through the peridotite. These gases were absorbed by the upper areas and soapstone was formed.

Observations on Occurrence

Mention has been made of the outcrop showing of the west vein, but it might be added that the texture of the stone in the outcrops is a very good indication of the nature of the stone underneath. The diorite dike that runs through this vein is never observed at the surface, because the freezing and thawing to which it is subjected have a much more deleterious effect upon the hard, brittle rock than upon the more elastic and weather-resisting soapstone. The soapstone float furthermore covers up the diorite rib.

The altered areas of the middle and east veins are indicated by the appearance of scattered crystals of the talc in the rock, which gradually increases in quantity until the peridotite characteristics of the rock have disappeared and in its place is typical soapstone. The surface of the ground is frequently strewn with large and small pieces of float from the vein. Where the vein does not outcrop at the surface, its presence is often indicated by this float. The float from the middle vein, as described, is stained red with iron oxide, although at times it may be a normal greenish color. It is invariably pitted with siderite cavities. This is also true of the appearance of the outcrop itself. The east vein shows a strong outcrop throughout its entire length, except where it is covered with detritus from the hillsides or from alluvial fans. (In one locality the middle and east veins have not been encountered by the writer. This is at some distance from the section now under observation, and may be due to pinching or to an alluvial covering, the latter being the more probable.)

What is the ideal soapstone ledge? It is a ledge that is wide enough to accommodate a large quarry; one of uniform grade, with an evenly-distributed quantity of talc throughout its mass; one with the minimum number and proportion of zones of weakness; one with the fewest fractures and few included diorite dikes.

The field study of these qualities is difficult, as the surface conditions are frequently misleading. Generally speaking, the width of the vein, as seen in the outcroppings, does not indicate the true width of the vein under the surface. This is true for various reasons. The resistance to weathering of the several zones or layers of soapstone is variable, consequently certain layers will show strong outcrops where neighboring zones may be entirely covered by alluvial deposits or residual clays, or may be indicated meagerly by scattered bits of badly-weathered float. Local topography may cause the outcrop to fan out at the surface, on account of slumping or other causes, thus mak-

ing the vein appear wider than it actually is. The interpretation of surface indications is a matter of careful study.

The grade of stone may be determined with reasonable accuracy if the whole vein is exposed. In studying the outcrop it is well to remember that some of the hardest subsurface layers, because of their brittleness and lack of elasticity, are weakest at the surface. For instance, the presence of the persistent diorite dike is not apparent at the surface, in spite of its superior hardness. It is interesting to note that the agents of weathering, such as sudden temperature changes, freezing and thawing, have a much greater effect on the granitoid rocks than on soapstone. Soapstone is noted for its heat-resisting ability, its elasticity, and its low moisture-absorbing qualities. These factors account for its relative prominence in outcrops, as compared with the schists and granitoid rocks with which it is associated.

For the same reason the harder layers of the middle vein are not as apparent at the surface as the true soapstone belts. These harder layers are not as thoroughly metamorphosed as are the softer ones and hence retain more of the original igneous characteristics than does soapstone. Therefore weathering is more complete.

In the case of the east vein the proximity of the easily-weathered schists on the east side and the talc content of the vein rock itself serve to make the outcrops of the vein stand out more prominently than either the schists or the adjacent peridotite. As to the relative prominence of the various zones in the vein itself, the talc content determines the strength of the outcrop, all other elements being equal. The east vein shows practically no iron stain at the surface.

The presence of siderite, which is confined to the middle vein, is easy to detect. Leached-out, reddish or greenish soapstone fragments are the most common indicators of the soapstone ledge, but they are not the most trustworthy indicators of the general quality of the ledge. This stained float often extends far beyond the bounds of the ledge and covers up the outcrop of siderite-free stone so fully that the true character of the stone can be discovered only by core-drilling.

It is practically impossible to locate the zones of great weakness by surface observation. Continuity of strike and dip and a general tendency of the ledge to maintain the same width and general quality are good indications that there are no unusual or prohibitively weak areas in the body aside from the inevitable water course which divides the vein. This water course, in the middle vein, if the deposit has not been disturbed by post-mineralization movements, will gradually pinch down to a dry seam and eventually disappear entirely.

The study of surface indications can give at best only approximate ideas as to the nature of the underlying stone. The best indicator is the outcrop of uniform resistance to the elements, with an even distribution of talc and a relative freedom from carbonate impurities. The core drill must be relied upon to verify or nullify these indications.

Formerly a series of trenches was dug at promising locations to uncover the outcrop more completely, as it was thought that a more satisfactory study of the qualities of the stone could be made in that way. This method is expensive and cannot compare with core-drilling, either in cost or scope of information obtained. The diamond drill will show the conditions at depth, will indicate the proportions and nature of the various grades of stone, and will give some information of fissures.

Diamond-Drilling

The location of holes for diamond-drilling is dependent on two main factors: (1) the strike and dip of the stone and (2) the nature of the topography. The drilling of soapstone should be conducted to cut the ledge as nearly as possible at right angles to the strike. This is generally accomplished through observation of the outcrop, although at times it is impossible to obtain sufficient data to enable one to point the holes correctly. In such a case the only thing to be done is to drill two or three trial holes so as to cut the ledge below the oxidation horizon. By this method it is often possible to prove the formations by very little drilling, which saves in cost. If the formation is sufficiently prominent at the surface, its full width may be observed and the length of the holes to be drilled may be calculated. This is exceptional, as the limits of the formation are frequently covered by a thick bed of residual material from adjacent schists, or the vein itself is narrow at the surface. It is necessary to do the first drilling in such a manner as to cut an excess of barren ground in this case. The first hole should show the relation between the subsurface structure and the outcrop. It has been observed that by drilling first at a rather steep angle, say from 35 degrees to 45 degrees and by locating these holes 50 to 60 ft. from the outcrop, the stone will be entered by the drill below the oxidation zone and will be left at a good depth. This practice is especially applicable to drilling in narrow veins and in localities where the cutting of country rock is expensive and tedious.

As is always the case in determining the salient factors of any problem, the engineer can do no better than to use common sense in locating holes with reference to the local topography. It is self-evident that the falling away of the ground from the outcrop is of vast help in obtaining depth for the holes with the minimum of drilling. In some cases it is sufficient to allow the hole to be drilled at flat angles of from 20 degrees to 25 degrees. If such is the case, the average depth of the hole may be great enough to be well within the unoxidized zone.

Drilling soapstone against the dip is apparently the best for development work, but it is often advantageous to drill alternate holes with the dip, if the stone does not lie too flat; a greater knowledge of the stone under the hanging wall may be obtained, and a more complete idea of the con-

tinuity of the central portion is possible. It is inadvisable to drill from the footwall side at an angle greater than 45 deg., the reason being that the drill is likely to run gradually out of line and to follow seams or hard strata of stone. Holes drilled alternately from both sides are advantageous for giving information at depth at both borders of the ledge, and this is a good way of testing the ledge with a minimum number of holes. The angle of the holes drilled from the hanging-wall side may be steep, but those from the footwall side should not exceed the maximum angle mentioned.

The spacing of holes along the strike for preliminary work may be as great as 300 ft., but in obtaining data for the opening of quarries it is necessary to place holes about 50 ft. apart.

Another method of detailed drilling is to space the holes at intervals of 100 ft. or more and to fan them in a vertical plane through vertical angles of from 15 deg. to 75 deg. or more, depending on the distance of the set-up from the formation and the dip of the vein.

In all cases it is important to drill through the footwall and the hanging wall, as a study of these is important in order to judge of the future possibilities of the quarry. Many good quarries have been ruined or made unprofitable by caving walls.

It is well to point a few of the holes so as to obtain data on the amount and nature of the overburden to be removed, otherwise it will be necessary to lay out a pattern of short, nearly vertical holes, drilled to the point where they cut the clean stone.

The drill records are of supreme importance to the conduct of a definite program. The log book should be kept in an orderly fashion, the actual location, angle, and serial number of the hole being entered at the beginning of each hole record. It is sometimes inconvenient to carry the notes in ink in the field, but they should be inked immediately after the typing of the report. The best method of keeping the depths is to record the total depth at each change in the stone and at the end of the day's drilling.

The cores should be preserved for more detailed examination, in specially constructed core-boxes. These boxes, made of pine boards, should be divided longitudinally by spacers of ½-in. plank, to prevent the cores from being mixed in the box while being hauled from place to place. The driller should be furnished with small smooth chips of soft wood on which to write the depth in feet at which each core barrel of stone was cut. Lumber crayon is satisfactory for this purpose. The serial number of the hole should be painted on each box as it is filled, and the lid should be securely nailed on to prevent loss of cores.

The drilling program is of no value unless these operating and recording methods are observed.

Quarrying

After the diamond-drilling, trenching, or outcrop examination of the soapstone ledge has resulted in a satisfactory settlement on location, the quarry stripping is begun. Several methods have been followed.

One instance is known to the writer of the combined use of hydraulic and excavation methods. In this case the heavier part of the work was performed by teams and scrapers, and the final clean-up was effected by the use of a water stream under pressure. The pressure was obtained by boosting the water from a neighboring stream into a stand-pipe. The overburden, which in this case was red clay, was removed to clean stone, then channeling machines were started directly on the uncovered outcrop. In this quarry good stone evidently was not reached until the fourth or fifth floor (30 ft. to 37 ft.) was reached. No explosives were used to remove the waste rock.

There seems to have been a very strong prejudice against the use of dynamite and powder in opening quarries at that time. This antipathy was founded on the fact that soapstone is likely to be sheared and made worthless if explosives are unwisely used in the immediate vicinity of good stone. Several quarries have been opened in recent years, however, in which explosives were used to remove the overburden. Just what the effect was upon the stone immediately under the shots is not known. It is probable that quite a volume of this stone was made worthless for large slab fabrication. There is a marked tendency for stone which has been subjected to this strain to split along the planes of greatest weakness; that is, in areas in which the cleavage cracks are filled with calcite and other impurities. Certain kinds of soapstone, the schistose variety in particular, do not hold together at all after dynamite has been used.

The judicious use even of high explosives under the direction of an expert explosives engineer could not be objected to in opening quarries or in dislodging useless blocks in the quarry already in operation. It is not safe so far as the workable beds are concerned to use dynamite promiscuously. It must be remembered that the soapstone business requires the production of large blocks, and that if these are not obtainable, the purpose of the business is nullified.

Other stripping methods in general use are (1) the steam-shovel method with a derrick in assistance and (2) the direct quarrying method wherein local conditions favor the removal of the first stone (generally worthless) by channeling, undercutting, and derrick-handling. The second method is seldom used because of its slowness, and the fact that the outcropping stone does not generally hold together well enough to permit it to be handled directly by the derrick.

The writer knows of no instance in which the hydraulic method has been employed from the outset with aerial tramways used in conjunction. Where a large quantity of loose, small material intermixed with dirt predominates, and where the terrain permits, it seems that the hydraulic stripping method would undoubtedly be advantageous.

(Continued in a forthcoming issue)

Road Building Forging Ahead This Year, General Survey Indicates

County Highway Officials to Meet This Week at St. Louis to Discuss Road Work

IN 1929, the highway departments of the 48 states improved a total of 32,522 miles of state highways, according to reports received from the departments by the Bureau of Public Roads, U. S. Dept. of Agriculture. In the year they expended a total of $910,485,291 for highways. They also reported a total of 314,136 miles of highways in the state systems at the end of 1929.

The total mileage improved is an increase of 3,270 miles over the 1928 figure, and includes 7,451 miles of graded and drained earth roads and 25,071 miles of new surfacing. New surfaces were placed on three types of roads—on unsurfaced roads, on roads already improved with a lower type of pavement, and on roads of the same type of surfacing, which is classed as reconstruction work. Of the 25,701 miles of new surfacing, 14,014 miles were laid on unsurfaced earth roads, 4,337 miles on a lower type of surfacing, and 6,720 miles on the same type of surfacing.

The types and mileages of new surfacings are as follows: sand-clay and topsoil, 2,399 miles; gravel, 12,183 miles; waterbound macadam (treated and untreated), 1,642 miles; bituminous macadam, 1,200 miles; sheet asphalt, 116 miles; bituminous concrete, 440 miles; Portland cement concrete, 6,991 miles; and brick and other block pavements, 100 miles.

The total of 314,136 miles in the state systems represents an increase of 7,694 miles over the 1928 figure, and includes 208,324 miles of surfaced highways, 28,553 miles of graded and drained roads, and 77,259 miles of unimproved and partly graded highways.

The surfaced mileage consists of 133,211 miles of low-type and 75,113 miles of high-type surfacing. The low-type surfaces include 15,442 miles of sand-clay and topsoil; 97,838 miles of gravel; and 19,931 miles of waterbound macadam. High-type surfaces include 14,043 miles of bituminous macadam; 1,498 miles of sheet asphalt; 5,722 miles of bituminous concrete; 50,584 miles of Portland cement concrete; and 3,266 miles of vitrified brick and other block pavements.

For construction and rights of way, the states spent $557,400,625; for maintenance, $173,060,321; for equipment and machinery, $18,056,509; for interest on outstanding bonds and notes, $45,834,531, and for miscellaneous items, $5,524,358. The states also paid out $42,384,378 in retirement of the principal of outstanding bonds and notes and transferred $45,791,374 to county and town funds for local roads. Other obligations assumed by the state highway departments amounted to $22,433,195.

The total sum available to the 48 states for 1929 for state highway and bridge work under supervision of state highway departments (including bond payments and transfers to counties) amounted to $1,194,775,026. This was made up of an unexpended balance of the previous year's funds of $232,967,988, and an income of $961,807,038. Of this sum, motor vehicle fees of $278,092,734 and gasoline tax receipts of $287,258,416 allotted to state highways represented more than 58 per cent. Sales of state bonds and notes issued for state highways amounted to $161,229,297, or more than 16¾ per cent of the income. Federal-aid fund allotments of $77,572,691 represented 8 per cent. Highway taxes levied in several states amounted to $11,431,349, and appropriations for highway funds by several states totaled $60,305,631. Miscellaneous income was reported as $11,726,508, and funds transferred from local authorities as $74,190,412. The states reported an unexpended balance of $284,289,735, at the end of 1929.

Road Work Progresses

In discussing the present status of road improvements in the United States, W. A. Van Duzer, president of the American Road Builders' Assn., remarked that road building is an industry that has shown no signs of financial depression and which will involve expenditure of two billion dollars this year. He has just completed a study of the progress of this great industry over a period of twenty years.

Research, education and the advent of motor vehicles and automotive power, have been the greatest contributing factors, he finds. He cites the research and educational efforts of the Road Builders' Assn., shown by the year book for 1930 in comparison with those of former years. In 1911, the organization, then eight years old, held its annual convention and road show in Rochester, N. Y., with 1,461 persons in attendance. "Attendance at our conventions recently has averaged more than 23,000 persons, and we expect that record to be considerably eclipsed when we gather in St. Louis next January. It is noted that, in the 1911 proceedings, delegates were present from Alabama, Maine and Washington. A modest exhibit of road building and paving equipment and materials was participated in by fifty-five manufacturers.

"The 1930 road show overflowed the capacity of the largest auditorium in America, and we were actually forced to turn down applications for space. The St. Louis arena offers us almost 250,000 sq. ft. of floor space and it is a foregone conclusion that it

will be taxed to capacity with the exhibits of more than 400 manufacturers of road-building equipment and materials.

"The Rochester convention sessions took up five leading questions before the industry, with the prepared papers by prominent highway engineers, followed by discussion by all delegates.

"The proceedings of our annual meeting last January in Atlantic City required a volume of 850 pages to include the 58 carefully prepared reports which were delivered. These reports were the result of a year of study and research by selected committees of specialists in their particular work. Their findings were correlated by engineers of the association staff, and the information can be accepted as authoritative and new.

"In addition, more than a score of excellent talks on topics closely allied with the industry were delivered at general and social sessions. The association work is now divided into city and county highway officials, contractors and other groups, and each devotes its major effort throughout the year and at convention time to its especial problems, yet all contributing to the general growth of information in road-building methods, materials and specifications.

"It is a pleasure to note that, at our last annual meeting, every highway department in the United States was represented as well as thirty-four nations. Since the states were thoroughly organized for highway work brought about by federal aid, much work has been done on the organization of counties for development of their road programs; and I predict that the day will come when each of the 3,078 counties will send a highway official to the association's great yearly gathering. Most of the important cities are already numbered in the membership of our city officials' division, and further progress is assured in the work for municipalities.

"It is impossible to estimate the great impetus that is given the good roads movement in all America each year by these conferences of highway builders from everywhere, and the road show which brings keen competition for refinement of equipment that will make an outstanding appeal.

"Of particular educational value to the industry is the fact that all the association's work toward betterment of roads and lessened construction costs are preserved for application through publication of this annual yearbook."

As verification of the interest which Mr. Van Duzer asserts is held by counties in the progress of improved-road building, the Dept. of Agriculture has released the following pertinent information. These figures should not be confused with the corresponding figures that apply to last year's state expenditures.

County Building Active

A total of 45,481 miles of local and county roads, exclusive of state highways, were improved in 1929 by the counties of the 48 states, as indicated by reports obtained from authorities of selected counties by the Bureau of Public Roads. These reports indicate a total of 2,710,097 miles of highway in the county-road systems.

The reports indicate that all counties spent a total of $807,714,604 in the year for county and local road and bridge construction, including payments on bonds and transfers to state highway departments. It is estimated that available funds amounted to $953,529,592. An unexpended balance of $145,814,988 was on hand at the end of the year.

Of the total mileage improved in the year, the reports indicate 29,804 miles, or 66 per cent, were surfaced, and 15,677 miles, or 34 per cent, were graded and drained earth roads. The surfaced mileage includes 2,905 miles of sand-clay and topsoil roads; 19,753 miles of gravel; 3,666 miles of waterbound macadam; 2,037 miles of bituminous macadam; 54 miles of sheet asphalt; 176 miles of bituminous concrete; 1,191 miles of Portland cement concrete; and 22 miles of brick and other block pavements.

The estimated total mileage in the county-road systems includes 454,111 miles of surfaced highways, including 416,770 miles of low-type and 37,341 miles of high-type surfacings. The low-type surfacings include 75,547 miles of sand-clay and topsoil; 292,463 miles of gravel; and 48,760 miles of waterbound macadam. The high-type surfacings include 16,692 miles of bituminous macadam; 1,539 miles of sheet asphalt; 4,057 miles of bituminous concrete; 13,254 miles of Portland cement concrete; and 1,799 miles of brick and other block pavements.

The reports from the selected counties indicate that all the counties spent $256,581,811 for construction; $260,477,801 for maintenance; and $49,455,959 for miscellaneous items; that they paid out $78,277,070 for interest on outstanding bonds and notes, and $106,032,780 in retirement of the principal on the bonds and notes; and transferred $56,889,183 to the states for work on state roads. The total disbursement is estimated to have been $807,714,604.

The reports indicate that all counties had an estimated total of $953,529,592 in available funds, consisting of an unexpended balance of $163,401,207 carried over from the previous year, and a total income of $790,128,385. To the total income, the motor vehicle license fees and gasoline tax receipts allotted to the counties—$51,886,324 and $70,492,878 respectively—contributed 15 per cent; receipts from local bond sales, amounting to $110,635,146 supplied 14 per cent; and the total road tax of $414,152,567 contributed 52 per cent. Appropriations from county general funds for the use in road work amounted to $75,018,526; transfer of funds from states to counties for local road work amounted to $31,714,578.

Meet at St. Louis

County highway officials from many states are to meet in St. Louis Friday, Aug. 15, at the Statler Hotel, in response to the call of Stanley Abel, president of the County Highway Officials' Division, American Road Builders' Assn. Mr. Abel is county supervisor of Kern county, Cal.

The occasion marks an open meeting of the di-

(*Continued on page* 68)

The Responsibility of the Foreman in Preventing Plant Accidents*

By GUY O. GARDNER
Superintendent, Ash Grove Lime & Portland Cement Co., Chanute, Kan.

AT the last regional meeting held in this city accident prevention in the cement industry was thoroughly discussed. Every phase of accident prevention, from the executive's standpoint, down through the mill, was considered through round-table discussion, papers, or addresses.

However, one phase of the prevention of accidents was not then and has not since been thoroughly discussed at these meetings, i. e., the foreman's responsibility in the prevention of accidents. That subject has been assigned to me. It was never more pertinent than now, when thoughtful preparation against industrial accidents is in order. The responsibility of the foreman from the angle of the foreman's opportunity is by no means an easy subject to handle and, in preparing this paper, I have sought and received the combined thought of men in our own organization as well as of other men throughout the industry.

In order that we may best understand the title of this paper I looked up the definition of the word *responsible* and found: "Answerable legally or morally for the discharge of a duty, trust, or debt; having capacity to perceive the distinction of right and wrong; able to meet obligations; involving accountability or obligation."

In taking up the responsibility of foremen in the direct charge of men there is a matter that takes precedence; and that is the supervision of such foremen or supervisors by other supervisors higher up. This supervision must determine whether subordinates are earnestly interested in every policy, including safety, sponsored by the management; because enthusiasm and support of any company policy will never boil up from the bottom: it must percolate down from the top.

A foreman with a thorough understanding of the company's policies, and interested and ambitious to further such interests at all times, will assume every responsibility in planning his work, in teaching his men, and in taking care of other activities in line with his job.

Foremen are not equipped naturally to lead and teach men, but they can be helped, by inclination and study, to carefully analyze every individual in their charge and to thus judge whether such material will fit in and help build up their organizations. It has been said that industry is not producing as much skilled help as it is consuming.

A foreman must be ambitious and the traits of loyalty and faithfulness will grow with his responsibilities. He will then be in better shape to reach his men and to win their confidence and respect. The workman becomes interested and wants to learn (most men really want to learn) and the foreman, instead of having just a responsibility, really has an opportunity to help others get bigger and better jobs. Thus he aids himself, the man, and industry.

The policy of a foreman in dealing with his men should be one of fairness in mind and practice, and he should be as free to commend his men as he is to criticize them. Criticisms, when made, should be given constructively, not destructively. A foreman who has a human appreciation of effort, and who earnestly tries to treat his men as he would have his boss treat him, is the foreman who fosters contentment and satisfaction, in both the safety of the worker and the quality of his work.

The foreman represents the company to the men. It is his duty and privilege to become conversant with the company's ideals and policies and to pass on to the men such information as will maintain or improve the organization. He plans his work beforehand, he places his men to the best advantage, he is ever studying the individual in order to keep the ranks filled in an emergency. Unpreparedness or hasty assignments have been the cause of many accidents.

As a foreman is a representative of the company to the men, he is likewise a representative of the men to the company. He considers and takes care of their inquiries or he submits them with his recommendations to the management.

The foreman's habits, ability, and knowledge of the work should command the respect of his men. With him patience should be a virtue as, sometimes, his efforts may appear unappreciated for a time. In case of an accident his defense usually is that the man was told not to continue an unsafe practice, perhaps told several times. Such a case shows a lack of understanding between the foreman and the man involved. The foreman had given an order but required no fulfilment.

We must assume that a foreman in any organization has been trained for a particular line of work, and that he knows from experience what his department is expected to do as its part in the company's production. The foreman, therefore, need not receive his orders, whether written or verbal, from his superior except in particular instances. Under ordinary conditions he already knows what is expected of him. He has been selected for this place because of his ability in his line of work, his capability in handling men, and his willingness to accept responsibilities—all of which are important qualifications in a foreman. He has been chosen by the superintendent, either from observation as a capable workman, or upon recommendation of someone else.

* Address, Portland Cement Assn., regional safety meeting, Kansas City, Mo., March 25, 1930.

He has probably been tried out in handling men as a subforeman, and he has been tested as to his willingness to accept responsibility.

A foreman can readily realize his responsibility to his superior as long as it deals with output or an obligation with which he is acquainted. He is usually a better paid man than his best mechanic, though he may not be a better workman, but he is able to assume responsibility and is paid in part for this quality. Some foremen seem unwilling to accept responsibility, when we turn from production to the safety and well-being of their men. If a foreman's order is given in such a way that it is not clear to the workman and the result is an accident, preponderance of blame should rest upon the foreman instead of upon the workman who started his job without clearly understanding his instructions.

We have often heard the statement made that 75 to 90 per cent of industrial accidents are the fault of the men themselves. It may be true that a large portion of industry's casualties occurred because of things which the men might have done, but did not do, but it is equally true that a large number of the same accidents could have been prevented by some things which the foreman could have done and did not do.

Statistics show that one lost-time accident is preceded by 28 reportable accidents, and by 300 accidents which do not result in actual injury. An employee who is injured as a result of an accident has, in the average case, made the same mistake or the same error of judgment, violated the same instructions, or taken the same chance many times before without, however, having been hurt.

In how many cases can mills attribute their accidents to improper safeguards? This question brings to the attention of the industry the vital fact that, if unsafe practices are controlled, our accidents will be controlled. Here lies the opportunity of the foreman.

If responsibility for accidents is fixed, the management is as responsible for an accident as the foreman, because the foreman is the direct agent of the management. If accidents continue under a foreman, the management is as responsible as the foreman for their continuance.

The foreman, the keyman of industry, not only should be carefully selected, but he should be held responsible for accidents in his department, and he should be backed up by the management to the fullest extent when the enforcement of safety rules is essential.

We realize that fixing this responsibility on the foreman is not a cure-all, and that the continuation of the employee's safety education is essential. Safeguarding of machinery must go on, but we believe that, when the management and the foremen come to recognize their common responsibility in accident prevention, the seriousness of our accidents will decrease.

Road Building Forging Ahead

(*Continued from page 66*)

vision's executive committee and the program covers all phases of the county highway problem. President Abel says: "The chief purpose of secondary roads is a wider service to the public, and our aim is to bring the county highway officials to study their road situations and possibilities with a view to step-by-step improvement that will bring about, by the most practicable methods, the greatest service to all.

"One of the most important steps needed in this direction is the adequate marking and maintenance of existing county roads in order to increase their traffic capacity. Then, by utilizing modern equipment and the best known practices of road construction, many of the present 2,000,000 miles of practically unimproved roads in the United States can be improved by low-cost surfaces to such an extent that they will carry all traffic of the next decade.

"Re-surfacing and widening is a matter of the greatest interest in county road work, particularly in the thickly populated centers or near to great cities. In many cases such treatment of existing roads is thought to be preferable to location and construction of new highways.

"The 5,000,000 farms now located on dirt roads are vitally interested in secondary road progress. Commercial traffic between cities must be gauged by the surface conditions of the poorest section of road over which loads must pass. Pleasure traffic of the cities is seeking the development of side roads that will provide an opportunity to get away from congested week-end and holiday traffic into restful rural retreats without sacrificing travel comfort and safety.

"State and federal governments are giving increased consideration to this problem and the American Road Builders' Assn. is working with them as well as with the counties. We hope to bring out in the St. Louis meeting the best practices of county-road improvement now in vogue in states where counties are well organized and adequately financed. There are many different methods of extending state aid to counties; of dividing gas tax between state and county systems; of drainage, paving and surfacing these roads; and of control of their traffic. We want to learn all of these and to select those which seem best as standards to be recommended by the association to all counties."

The County Officials' Division will focus its attention this year on the states immediately surrounding St. Louis where the 1931 convention and road show of the association will be held next January.

In pursuance of this plan, Chas. E. Grubb, Washington, D. C., division engineer executive, will remain in the vicinity of St. Louis for several weeks following the executive session, visiting county officials in Iowa, Illinois, Missouri and Kansas, and conferring with them in detail regarding problems.

Others on the program will be Thomas H. Cutler, chief engineer, state highway department of Missouri; Otto Hess, county commissioner, Grand Rapids, Mich.; and E. A. Griffith, chief engineer of roads, Pittsburgh, Pa.

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is selected without significance as to current events or the position of the individual in the industry.

W. L. WHITE, JR.
General Superintendent
Medusa Portland Cement Co.
Cleveland, O.

Personal Mention

E. G. Meiklejohn and **E. B. Wyman** have filed suit in superior court at Los Angeles, Cal., against the Monolith Portland Cement Co. over the patent rights and alleged unpaid royalty on plastic cement manufactured by the company.

Robert C. Carter and **Byron J. Lapham** have been elected directors of the Glens Falls Portland Cement Co., Glens Falls, N. Y., to succeed the late Arthur W. Sherman and John E. Parry. Mr. Carter was elected treasurer to succeed Mr. Sherman, and **F. W. Wait** was elected secretary, succeeding Mr. Parry. **Loren F. Goodson** was appointed assistant treasurer.

Ward P. Christie, for the last ten years staff engineer of the Associated General Contractors, recently resigned his position to become connected with Ulen & Co., and will be located at the principal offices of the company in Lebanon, Ind. Mr. Christie is a graduate of Purdue University, class of 1915.

J. C. Noll, paymaster of the Hoffman gravel plant, at South Bend, Ind., was robbed of $1,000 Saturday, July 26, by a young, well dressed gunman. It was believed the man was either an employee or a confederate of an employee of the company, according to press reports.

Charles E. Grubb, formerly county engineer of New Castle County, Del., and past president of the County Highway Officials' Division, has been appointed as engineer-executive of the County Highway Officials' Division of the American Road Builders' Assn. by President W. A. Van Duzer.

E. J. Krause, president of Columbia Quarry Co., St. Louis, Mo., has been appointed, by President W. F. Wise of the National Crushed Stone Association, chairman of the entertainment committee for the next annual convention of the association, which will be held in St. Louis, Jan. 19 to 22, 1931.

John H. Neafie, formerly associated with Neafie & Fanning, New York, N. Y., has acquired Mr. Fanning's interest in the partnership and will continue under his own name to represent The Fate-Root-Heath Co. (Plymouth Locomotive Works) in New York and New England with new and larger headquarters at 115 Broad St., New York, N. Y.

L. H. Harvey, formerly advertising manager of the National Gypsum Co., Buffalo, N. Y., has joined the Sweeney & James Co., Cleveland advertising agency.

Maj. Aaron E. Carpenter.

Major Aaron E. Carpenter, first vice-president of E. F. Houghton & Co., Philadelphia, manufacturers of oils and leathers for the industries, has returned from an extended business survey in France, Germany, Poland, Russia and England. The trip was successful, revealing, as it did, the state of foreign business and providing valuable data on European manufacturing and marketing conditions, Major Carpenter declares.

E. D. Coddington has completed a $20,000 addition to his gypsum-products plant at North Milwaukee, Wis. The new facilities were installed to permit the manufacture of gypsum plaster.

Walter R. Talbot of Winchester, Va., has formed the Virginia Glass Sand Corp. The company will begin production shortly, it is reported.

W. B. Ewing, president of the American Mineral Products Co., Inc., of Hartford, Conn., has announced that the company will install machinery at Bellows Falls, Vt., to grind feldspar and mica.

A. J. Ladenburger recently sold his sand and gravel deposit near Morse Bluff, Neb., to the Central Bridge & Construction Co. of Wahoo, Neb.

William H. Searight, for several years with the American Gas Accumulator Co. as western manager, has recently joined the staff of the Joy Manufacturing Co., Franklin, Pa., as assistant sales manager in charge of snow-loading and surface material-handling development.

Obituary

Frank J. Oakes, 54-year-old general superintendent of the Dodge works of Link-Belt Co., Indianapolis, Ind., died suddenly at his home on July 19 of apoplexy.

Mr. Oakes was active in local business and lodge activities and was well known in the mechanical engineering field. Mr. Oakes was a recognized authority on mechanical engineering and, during the World War, was selected by the Government as a designer and adviser in the manufacture of munitions. He was sent to Europe by the Link-Belt Co. to investigate new mechanical inventions and to study chain manufacturing processes. He was a pioneer in developing processes for the heat treatment of steel and contributed valuable information to heat treaters as a result of his experiments. He also held patents on inventions in the chain industry and in other fields.

Mr. Oakes was a member of the Society of Automotive Engineers, the American Society of Steel Treaters, the American Gear Manufacturers' Assn. and several other engineering societies.

George Spiegel, aged 20, son of Mr. and Mrs. John Spiegel of Petoskey, Mich., was drowned in Intermediate River, five miles north of Bellaire, Mich., last month. The boy's father is an official of the Petoskey Portland Cement Co.

Peter Martin, lime manufacturer, died recently at his home in Huntington, Ind. Mr. Martin was 75 years of age. He was a pioneer member of the National Lime Assn. and for many years operated the Western Lime Co. in Ohio, the company having subsequently been absorbed by the Kelley Island Lime & Transport Co.

Raymond Kersh, 26, Mishawaka, Ind., was drowned recently in a gravel pit at South Bend, Ind., when a three-ton truck he was backing to the edge of the pit plunged down as the earth caved in, turned over and sank in 30 feet of water.

M. G. Matson, auditor of the firm of Swigert, Hart & Yett, of Portland, Ore., died recently in a Portland hospital after undergoing an operation. Mr. Matson was a pioneer employee of the firm.

B. H. Heyward, president of the Winnsboro Granite Corp., met his death last month while on an inspection trip in the company's Anderson, S. C., quarry. Mr. Heyward was caught under a block of granite when a hoisting chain broke. He was 70 years old.

Coming Events

Sept. 9, 1930. Seattle, Wash. Portland Cement Association regional safety meeting, at New Washington Hotel. A. J. R. Curtis secretary, 33 W. Grand Ave., Chicago, Ill.

Sept. 9, 1930. Chicago, Ill. Regular meeting, Gypsum Assn., Bismarck Hotel. Henry J. Schweim, executive secretary, 211 W. Wacker Drive, Chicago, Ill.

Sept. 14-20, Springfield, Mass. Fourteenth annual Eastern States Exposition. Industrial Arts Exhibition in connection.

Sept. 16, 1930. San Francisco, Cal. Portland Cement Association regional safety meeting, at St. Francis Hotel. A. J. R. Curtis, secretary, 33 W. Grand Ave., Chicago, Ill.

Sept. 18-19, 1930, Chicago, Ill. Annual meeting, Manufacturers' Division, National Sand and Gravel Assn. at Stevens Hotel. V. P. Ahearn, executive secretary, Munsey Bldg., Washington, D. C.

Sept. 23, 1930. Ogden, Utah. Portland Cement Association regional safety meeting. Hotel Bigelow. A. J. R. Curtis, secretary, 33 W. Grand Ave., Chicago, Ill.

Sept. 29-Oct. 3, 1930, Pittsburgh, Pa. Annual congress and exposition. National Safety Council, William Penn Hotel. W. H. Cameron, managing director, 20 N. Wacker Drive, Chicago.

October 6-10, 1930, Washington, D. C. Sixth International Road Congress at invitation of the United States Government. Thos. H. McDonald, chief of the United States Bureau of Public Roads, secretary-general of the American Organizing Commission. International Road Exposition in charge of the American Road Builders' Association. Charles M. Upham, engineer - director, National Press Bldg., Washington, D. C.

Nov. 17-19, Chicago, Ill. Annual meeting, Portland Cement Association, at Blackstone Hotel. Wm. M. Kinney, secretary, 33 W. Grand Ave., Chicago, Ill. (Open to Association members only.)

Dec. 1-5, 1930. Memphis, Tenn. Ninth Annual Asphalt Paving Conference of the Asphalt Institute. Meeting of the Association of Asphalt Paving Technologists in conjunction.

Dec. 1-6, 1930. New York, N. Y. National Power Show, Grand Central Palace.

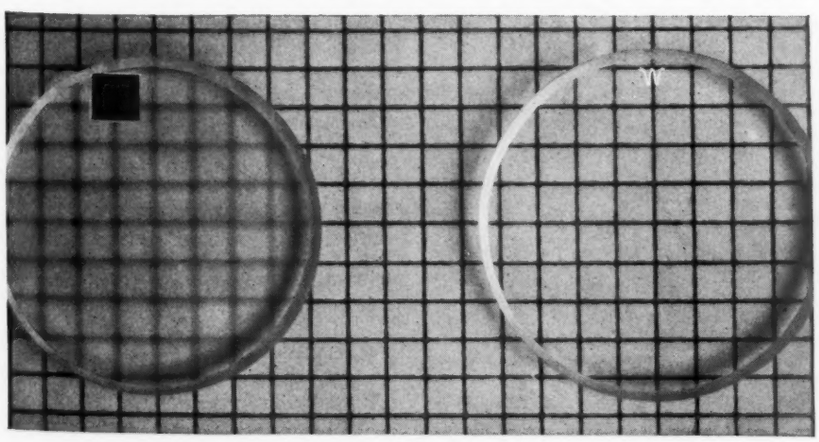
Jan. 19-22. St. Louis, Mo. Annual Convention National Crushed Stone Assn., Hotel Jefferson. J. R. Boyd, secretary, 1735 14th St., N. W., Washington, D. C.

Jan. 27-29, 1931. St. Louis, Mo. Annual convention National Sand & Gravel Assn., Hotel Jefferson. V. P. Ahearn, executive secretary, Washington, D. C.

Tests Reveal Main Reason Why Men Dislike to Wear Goggles

The workman who, no matter how dangerous his job, will not wear goggles is not always as unreasonable as his conduct indicates. The accompanying illustration gives a fair idea of what causes such refractory behavior, and very nearly convinces one that the workman who "takes a chance" leaving off his goggles is justified.

A camera has been used to show what the eyes feel but cannot see without the aid of some instrument such as a transit. The photograph from which the accompanying illustration was made had not been treated or retouched, except to remove the trademark.



The above illustration shows finely-ruled paper, magnified to twice normal size; placed 22 in. from the camera. Inside the circle to the right are shown the rulings as they appear through a hardened and tested safety goggle lens; (left), the same pattern photographed through a hardened lens of uncertain manufacture.

Because the eye nerves adjust themselves to the distortion and aberration caused by the wavy surfaces and brittleness of imperfectly hardened lenses, the blur and distortion recorded by the camera is not seen by the naked eye. The continuous strain of adjusting eye-muscles to irregular, unbalanced conditions, one eye probably strained in a different manner than the other, causes eye-strain, headaches and general fatigue.

In many industries throughout the country where eye hazard is excessive, many men can be found who leave off the goggles provided by their companies and run the risk of losing one or both eyes rather than wear daily, for several consecutive hours, goggles which strain the eyes and produce headache and nervous fatigue.

In many instances, men have been dismissed because of their laxity in goggle wearing habits, in an attempt to impress the necessity for care on other workmen. In many more cases, eyesight has been lost, and in these cases no amount of money can repay the victims for their neglect, though their employing companies are called on to pay thousands of dollars.

Several thousands of eyes are lost in industry every year in the United States. If there is any way of lowering the figure in any industry, the effort spent in investigation may not be counted wasted. In the State of Pennsylvania alone an average of 50 eyes are lost each month. This number is quoted from the figures published by the Pennsylvania Department of Labor and Industry in its monthly "Bulletin."

When tested by the latest scientific methods prescribed by the U. S. Navy and Federal Specifications Board, most available safety lenses show excessive aberration and distortion which cause physical discomfort to the wearers and often discord and misunderstanding between workman and company.

The data mentioned in this article and the illustration that accompanies it were furnished by Willson Products, Inc., maker of safety appliances at Reading, Pa.

New Acetylene Plant in Operation in Wyoming

The Prest-O-Lite Co., Inc., New York, N. Y., has placed in operation a new plant for the manufacture and distribution of dissolved acetylene at Casper, Wyo. The new plant has been built to accommodate the increasing need of users of the oxy-acetylene welding and cutting process in that region. The plant is located on a private siding of the Chicago, Burlington & Quincy R. R.

Correct Training of Belt and Proper Use of Idlers Important in Operating Conveyors

By W. E. PHILIPS
Engineer, Link-Belt Co., Chicago, Ill.

CONVEYING large quantities of material at a low cost per ton is work to which the belt conveyor is admirably suited due to its small power consumption and the large capacity that results from its continuous delivery of material at a relatively high speed.

Coordination of the idler and the belt in making a perfect belt conveyor installation is essential. To keep the power consumption and belt maintenance expense down to rock bottom, it is necessary that a good "roadbed" be provided for the travel of the belt in both the carrying and return runs—a roadbed that will not only protect the belt adequately, but will also reduce friction loads to the lowest possible point.

That roadbed really consists of the idlers. It is not difficult to see that poorly constructed idlers can be just as damaging to a conveyor belt as bad roads are to automobile tires.

When the idler rolls are accurately made and free-turning, friction is reduced to the minimum, and power is saved. You really cannot make the roadbed for conveyor belts "too good," and this is why special attention should be given to the construction of the idlers.

Belt-conveyor service demands a bearing that will carry both heavy radial and heavy thrust loads, on an anti-friction basis. At the same time, the bearings must run with little attention year in and year out.

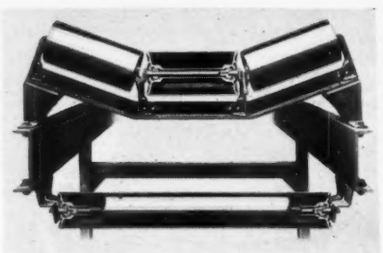
But regardless of the bearing's importance, it takes more than just bearings to make a superior belt roll and idler. The bearings must be properly mounted, so they will maintain perfect alignment under all conditions of service. They should have a quick and efficient means of lubrication. The grease reservoir should be large enough to make frequent refilling unnecessary. The roll's construction should keep the dirt and grit out, and the grease in. The rolls should be rugged, yet of simple design with all parts readily accessible, and they should be both interchangeable and easily removable from their supporting stands.

A heavy-duty anti-friction idler has been developed especially for the mining industry. The rolls are 8-in.-diam. ⅜-in.-thick boiler tubing mounted on 1¼-in.-diam. shafts and equipped with Timken bearings and Alemite lubrication. It is available in sizes for belt widths of 36 in. to 60 in.

The belt, which comes into direct contact with the material handled, is necessarily subject to wear, and an expensive part of the conveyor from a maintenance standpoint, especially where abrasive materials and large jagged lumps must be carried.

In selecting a belt to give most economical service, therefore, it is necessary to consider the nature of material handled, the methods of feed and discharge, and other conditions of wear; and then to provide a belt which has proper construction, detail design, flexibility, number of ply, thickness of cover, strength and high quality of duck and rubber to meet the individual requirements, with a maximum efficiency and durability, at a minimum cost in the long run.

The type of drive used has much to do with the selection of the thickness and grade of conveyor belt required. For instance, in a long conveyor, where a plain unlagged drive pulley would necessitate the use of an 11-ply conveyor belt, to stand enough tension to make the pulley drive the belt without slipping, a hugger drive would need only 6 plies; and that means a material saving in the price of the belt, as well as in the friction and the loss of power involved in a plain pulley drive.



Anti-friction, 3-roll conveyor idler.

The loading conditions are important, as everything should be arranged to have material reach the belt in the same direction and at the same speed as those of the belt; and with as little drop and impact as practicable, especially where the material is abrasive or sharp pointed and heavy. Suitable feeders also increase the carrying capacity, by regulating the delivery to the belt at a uniform maximum practical rate.

Structural design of conveyor belts is of utmost importance, and regardless of the quality of the material used, a belt cannot function satisfactorily without correct design and uniformity of parts.

In specifying the quality of conveyor belt for a job, proper balance is of vital importance. Belts must be built of a proper thickness and quality of cover, combined with a carcass of corresponding quality. Proper balance can be determined only through wide experience in the observation of belt service in handling all classes of material, and through complete knowledge of loading conditions, method of

Anti-friction conveyor on trestle, discharging over wing shuttle electric tripper to 30-ft. shuttle belt.

Anti-friction conveyor handling rock from crusher to storage, Republic Portland Cement Co., Longhorn, Tex.

discharge, type of drive, type of idlers over which the belt operates, character of material to be carried, tonnage to be handled, and many other details, all of which are important factors in the building of a balanced belt.

A belt should conform naturally to the gradual trough of the idlers by its own weight. If too stiff, it will ride the inclined rolls, making it impossible to be trained to run central on the idlers.

More belts have been ruined by overplying than by under-plying. Proper plying of belts can be determined best by a manufacturer of conveying machinery who is in a position to know the details of belt requirements and who can furnish a belt suited for its particular work.

There are several things to consider in the training of the belt. When a belt runs out of line, the cause should be found and corrected at once. Belts should always run true and central on the carrying and return idlers, when loaded or empty. Otherwise the belt edges will wear against frames or other obstructions, and the bottom of the belt is subjected to injury by riding on the edges of the troughing idlers.

If one part of a conveyor belt runs true and central on the idlers, while another part runs out of line, the belt is crooked. If the part that runs out is at the splice, it is probable that the splice or joint is not square.

On the other hand, if the belt runs out steadily at any one point in the conveyor—that is, if it keeps running out on the same idlers, the idlers are out of line. Usually the idler that causes the trouble is just behind the point where the belt starts out of line.

Belts should be trained while empty. If, when loaded, they run out of line, it is due probably to unequal loading. Correction of the loading chute is the remedy.

Belts cannot be made to run true by adjustment of the take-up screws or the head pulley. Both tail and head pulleys should be set in alignment and kept so. All other training should be done by the idlers.

The center roll of the troughing idler must be in contact with the belt, for it is really this roll that steers or trains the belt, unless belts are overplied or too stiff to assume the shape of the idlers when empty.

Idlers should be kept square with the belt. When training a belt by lining up the idlers, always work with the direction of travel.

Stuck, or sluggish idler rolls tend to deflect the belt.

Foundations or conveyor supports, if not secure or solid, may be responsible for bad alignment of belts.

Side-guide idlers or self-aligning idlers should never be used while training a belt. Guide idlers bearing against the edge of a belt are frequently the cause of excessive wear and premature failure of the belt. They loosen up the edges, thereby permitting the entrance of moisture and dirt between the plies of the fabric.

It is a mistake to try to train a belt by increasing the tension. This not only strains the driving mechanism, but increases the horsepower requirements, puts an unnecessary stress on the belt, weakens the splice, takes out the troughing of the belt, and eliminates the effective training action of the center idler roll.

Tripper pulleys should be inspected regularly, to see that belts do not scrape against the frame, and that the belt runs true over the pulleys of the tripper.

Skirt-boards should not come in contact with the belt, and should be cut away or set in such a position that the space between the belt and board increases in the direction of the belt travel, thus permitting the pieces of material to work free, rather than to become wedged against the belt, to gouge the cover, and to push the belt to one side of the idlers.

The belt conveyor is ideal for low-cost conveying, and the illustrations show a few of the many practical applications of this type conveyor.

Link-Belt Occupies New Frisco Plant Building

Link-Belt Co., Pacific Division, has moved into its new manufacturing plant and office, at Paul Avenue, near Bayshore Highway, San Francisco, Cal., from the old plant in a different section of the city.

This added unit to Link-Belt's sixteen plants and warehouses, located throughout North America, comprises a two-story office building of Spanish design; a warehouse 80 ft. by 120 ft., three stories high; and the manufacturing building, containing the machine shop, steel shop, plant office, and their auxiliary departments. Within this plant, designed to give quick, efficient service to customers, are manufactured all kinds of elevating, conveying and power-transmission machinery. This is a modern plant, employing the latest designs in tools, most up-to-date production methods, and an engineering organization capable of applying labor-saving machinery for every industry.

Transit-Mixed Concrete Demonstrated in Europe

The first practical demonstration of transit-mixed concrete in Europe took place at the Sentinel Wagon Works at Shrewsbury, England, recently, according to *The Quarry-Manager's Journal* (London). Paris transit-mixer bodies were mounted on Sentinel steam-operated trucks for the exhibition, by arrangement with Transit Mixers, Inc., of San Francisco through its British agency, The British Steel Piling Co., Ltd., of London.

A number of engineers and contractors attended the demonstration and were highly impressed by this modern method of mixing and delivering quality concrete, the *Journal* declares.

District Sales Office Located at Birmingham

General Refractories Co. announces the opening of a new district sales office in Birmingham, Ala. This office, located in the Empire Building and in charge of Walter S. Stapler, will enable the company to more adequately serve refractory users in the southeastern territory.

Financial News

The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of PIT AND QUARRY, *for which no responsibility in any way is to attach to this magazine or to any of its staff.*

International Cement Expects Aid by Tariff

A dispatch from the Boston News Bureau recently stated that for the six months ended June 30, 1930, the net income of the International Cement Corp. probably would come close to the showing made a year ago in which earnings for that period were $3.50 a share on the common stock.

The agency said that, while the duty on cement of six cents a hundred pounds did not begin to equalize production costs here and abroad, it at least helped, and to that extent was a favorable development for the domestic cement industry. The International Cement Corp., it was stated, had managed to maintain a favorable rate of earnings even without tariff protection, thanks to its plants in Buenos Aires, Havana, and Montevideo.

If earnings of domestic plants had been segregated, they probably would have reflected competition of foreign cement, which had affected adversely cement prices along the seaboard and compelled the International Corp. to shut down its Norfolk, Va., plant last August. Along the seaboard and to the extent that foreign cement had been penetrating the interior it was expected that the new tariff would exert a beneficial effect upon prices.

Warner Company's Sales and Income Are Lower

Warner Co., incorporated in March, 1929, to take over the sand, gravel and limestone business established in 1794, reported net income for the six months ended June 30, 1930, of $343,154, equal after preferred dividend requirements to $1.47 a common share. For the period April 8, 1929, to December 31, 1929, the first nine months of the present company's operations, a net income of $1,318,130 was reported, equal to $4.25 a common share after preferred dividends.

The income account is as follows, for six months ending June 30, 1930: total operating income, $740,394; available for common stock, $343,154; earned per share common, $1.47, based on 234,048 common shares.

The report of Warner Co. for the six months ended June 30, 1930, stated that an additional amount of $526,500 of the company's underlying obligations were retired during the past month, following retirement of $1,366,-620 of such obligations in the first year of the company's operation, making a total of $1,893,120.

Sales in May, 1930, were $1,257,564 or 13.2 per cent under that month last year; while June, 1930, the figure of $1,220,887 represented a decline of 2.6 per cent.

International Salt Co. Reports Gain in Profits

International Salt Co. and subsidiaries report, for six months ended June 30, 1930, a profit of $322,901 after charges and bond-sinking fund, but before Federal taxes; comparing with $231,298 in the first half of 1929. Capital stock on June 30 amounted to 240,000 no-par shares.

In the like 1928 period earnings of $3,108 were small due to price cutting that started late in 1927, but this was offset somewhat in the last six months of 1928 with $344,477 earned, compared with $448,398 in the last six months of 1929.

The following table shows net income, after all charges but before taxes, for six-months' periods in the last four years.

	June 30	Dec. 31
1929	$231,299	$448,398
1928	3,108	344,477
1927	160,620	118,457
1926	148,611	353,477

International Salt's earning power has been materially benefited by an extensive advertising campaign which it has been conducting for the last five or six years. The company's five-cent package has gained a very wide sale. Based on sales in 1929 and 1930 to date, the company expects to market 50,000,000 packages of salt this year, ranging in size from the five-cent box to the eight-pound bag. On the above basis carton sales will be nearly four times those of 1922. The last half of the year generally furnishes the largest part of the company's annual volume.

It has just been announced that the stockholders of International Salt Co. subscribed for about 95 per cent of the 60,000 no-par capital shares to which they were offered rights at $36 per share. These rights expired July 21 and the remaining 5 per cent of the new stock was taken by the underwriters.

Proceeds of this financing will be used to liquidate existing bank loans, thus effecting a saving in interest of about $100,000 a year.

Bessemer Limestone and Cement Has Good Report

The report of Bessemer Limestone and Cement Co. for the six months ended June 30, 1930, shows net income of $114,321, equivalent to $2.28 per class A participating preference share and 39 cents per class B share. The maximum participation to which the Class A stock was entitled amounted to $1.50 a share.

Unfortunately no comparison is available with the first six months of last year but, for the full year 1929, a net income of $393,683 was reported. This was equivalent to $7.87 per share on the Class A stock and $2.43 per share on the Class B stock.

The regular 75-cent quarterly dividend was declared payable Aug. 1, 1930, on the Class A stock. No dividends have been paid on the Class B since Feb. 1, 1929.

CURRENT DIVIDENDS

Company	Class of Stock	Dividend Rate	Holders of Record	Payable
Alpha Portland Cement	Preferred	1¾% qr.	Sept. 1	Sept. 15
American Brick Co	Preferred	$0.50 qr.	July 25	Aug. 1
Bessemer Limestone & Cement	Class A	$0.75 qr.	July 19	Aug. 1
Cleveland Stone Quarries	Common	$0.75 qr.	Aug. 15	Sept. 1
Consolidated Sand and Gravel	Preferred	1¾% qr.	July 30	Aug. 15
Construction Materials	Preferred	$0.87½qr.	July 24	Aug. 1
General Asphalt	Preferred	1¼% qr.	Aug. 15	Sept. 1
General Asphalt	Common	$1.00 qr.	Aug. 28	Sept. 15
General Refractories	Common	$0.75 qr.	Aug. 12	Aug. 26
Indiana Limestone	Preferred	1¾% qr.	Aug. 20	Sept. 1
Kentucky Consolidated Stone	Preferred	1¾% qr.	July 15	Aug. 1
Kentucky Rock Asphalt	Preferred	1¾% qr.	Aug. 15	Sept. 3
Lehigh Portland Cement	Common	$0.62½qr.	July 14	Aug. 1
Material Service Corp		$0.50 qr.	Aug. 15	Sept. 1
Metropolitan Paving Brick	Common	$0.50 qr.	Aug. 15	Sept. 1
Missouri Portland Cement		$0.50 qr.	July 19	Aug. 1
National Brick of Laprarie	Preferred	$0.75 qr.	Aug. 31	Sept. 15
Pacific Clay Products		$0.60 qr.	July 20	Aug. 1
Raybestos Manhattan	Common	$0.65 qr.	Sept. 2	Sept. 16
Raymond Concrete Pile	Preferred	$0.75 qr.	July 20	Aug. 1
Raymond Concrete Pile	Common	$1.00 qr.	July 20	Aug. 1
Riverside Cement	1st Pfd.	$1.50 qr.	July 15	Aug. 1
Riverside Cement	Class A	$0.31¼qr.	July 15	Aug. 1
Standard Paving and Materials, Ltd	Preferred	1¾% qr.	Aug. 2	Aug. 15
Standard Paving and Materials, Ltd	Common	$0.50 qr.	Aug. 2	Aug. 15
Superior Portland Cement	Class A	$0.27½ M	Aug. 23	Sept. 1
Texas Gulf Sulphur		$1.00 qr.	Sept. 3	Sept. 15
Virginia Carolina Chemical	Pr. Pfd.	1¾% qr.	Aug. 17	Sept. 1
Wolverine Portland Cement		$0.15 qr.	Aug. 5	Aug. 15
Worcester Salt Co	Preferred	1½% qr.	Aug. 10	Aug. 15

Traffic News and Comment

Scrap Mica

The Interstate Commerce Commission, in Richmond Mica Corp. versus the Atlantic Coast Line Railway, et al., has found that the rates on scrap mica, in carloads, from Franklin, N. C., to Richmond, N. C., prior to September, 1928, were unreasonable, also rates on like traffic from other North Carolina points. Reasonable rates were prescribed and reparation awarded.

Portland Cement

The recent extension of the Beaver, Meade & Englewood R. R. to stations Hovey, Tracy and Eva, Okla., has prompted the establishment of new rates to those stations. The carriers have the following rates under consideration in Southwestern Freight Bureau, Docket 20,804.

From	Rate
Kansas City	24 cents
Chanute	23½ cents
St. Louis	35 cents
Hannibal	32½ cents
Marquette	37½ cents
Foreman	32 cents
Ada	24½ cents
Superior	25 cents

The Consolidated Cement Co. has filed a formal complaint with the Interstate Commerce Commission in which it alleges that the rates on cement from Mildred and Fredonia, Kan., to destinations in the states of Arkansas and Louisiana are unreasonable. The complaint charges also that the rates from competing producing mills located in the states of Alabama, Kansas, Louisiana, Missouri, Oklahoma, Tennessee, and Texas are preferential to those mills and prejudicial to Mildred and Fredonia.

Refund of excess freight charges is sought in I. C. C. Docket 23,647.

Announce Important Class-Rate Decisions

A great amount of general interest has developed throughout the country due to the Interstate Commerce Commission's findings in two important class-rate decisions just announced.

Docket 15,879 prescribes a new level as well as a new basis for rates throughout the territory north of North Carolina and Kentucky and east of the Mississippi River; while Docket 17,000, part 2, announces new rates for the territory west of the Mississippi River on a higher level.

The rates resulting from these decisions coupled with the new rates recently established in the Southeast and the Southwest, give us an entirely new set-up in class rates throughout the entire country lying east of the Rocky Mountains.

The movements of low-grade, heavy-loading commodities such as sand, gravel and stone, on class rates, is both rare and insignificant and there is nothing in these decisions to change this situation.

Generally speaking, the existing commodity rates on the low-grade articles just mentioned have been brought into being by the most severe kind of competition. In all probability, competition will continue to be the most important element in the making of such rates. In offering this comment we are not unmindful of the fact that, during the last ten years, we have seen rates on many articles readjusted to existing class rates and to mileage scales which totally ignore severe competition at particular points. After all, there is a possibility that, some day, rates on sand, gravel, and stone will be made in relation to the first class rates. We earnestly hope, however, that the day is far away.

To illustrate our point, let us consider the scrap-iron industry which is also a very competitive one. Generally speaking, the rates on this commodity have been put in force through market competition, and rates were made "on what the traffic will bear." However, last month, the Interstate Commerce Commission prescribed a new line of rates on scrap iron within and from points in the Southwest; in fact, a dual basis is to be established. The new alternative rates will be 15 per cent of first-class, with minimum of 50,000 lb. and 12½ per cent of first-class with minimum of 75,000 lb.

If this can be done in Southwestern territory, may it not be extended to Eastern and Western territory? If on scrap iron, why not on other low grade commodities.

We shall have more to say about this method of making rates in an early issue.

Crushed Stone

A shipper has asked the Eastern Trunk Line carriers (in T. L. A. Docket 24,042) to reduce the present rates on crushed stone from Shackamaxon station (Philadelphia), Pa., as follows:

To	Present rate	Rate sought
Ardmore	$0.90	$0.70
Bryn Mawr	0.90	0.70
Rosemont	0.90	0.70
Villanova	1.05	0.75
Radnor	1.05	0.75
Strafford	1.05	0.75
Devon	1.05	0.80
Paoli	1.05	0.80

The Wabash Railway has been asked to publish commodity rates on crushed stone from Pontiac, Ill., to various stations on its line in Illinois. At the present time, class-rates apply.

The proposal is covered by Illinois Freight Assn. I. R. C. Docket 5,792 and contemplates the following representative rates:

To	Rate
Decatur, Ill.	$0.88
Altamont, Ill.	1.15
Streator, Ill.	0.63
Danville, Ill.	1.10
East St. Louis, Ill.	1.35

Sand and Gravel

Central Freight Assn. Docket 25,687 covers requests of a shipper for revision of rates on sand and gravel from Earlville and Hugo, O., to various destinations within the state, of which the following are typical:

To	From Earlville	From Hugo
Bedford	$0.60	$0.65
Beloit	0.70	0.70
Niles	0.75	0.75
Lordstown	0.80	0.80
North Jackson	0.80	0.80
Champion	0.80	0.80
Summitville	0.85	0.85
Rome	0.90	0.90
Crestline	1.15	1.15

Granulated Slag

The railroads have been asked to reduce the rates on granulated slag (to be used as an aggregate for lightweight concrete) from South Chicago, Ill., and Indiana Harbor, Ind., to various destinations in Illinois. (Illinois Freight Association, Docket 5,719A.)

Present and proposed rates to representative points are shown below:

To	Present rates	Proposed rates
Belvidere, Ill.	$2.00	$1.10
Dixon, Ill.	2.20	1.35
Springfield, Ill.	1.64	1.26

Chain Belt Names New District Distributors

Chain Belt Co., Milwaukee, Wis., announces the appointment of the following firms as distributors of Rex construction equipment: The Equipment Corp. of Arizona at Phoenix; F. C. Crane Co., Dallas, Tex.; Joe C. Tucker, Morganfield, Ky.; Tract-Type Tractor and Equipment Co., Amarillo, Tex.; and Concrete Products Co., Oakland, Cal.

The company also announces the appointment of E. C. Atkins & Co., Inc., of Memphis, Tenn., as chain and power transmission representatives.

The Atlanta office of the company has recently moved to 407-408 Bona Allen Bldg., Atlanta, Ga.

W. S. Keller, president of the Empire Sand & Gravel Co. of Marshalltown, Ia., reports his company will open a new plant at Bromley, Ia., shortly.

Review of Foreign Practice

Sand-Producing Methods in Schleswig-Holstein

Sand and gravel deposits are not rare in any part of Schleswig-Holstein, but the most important of them lie in a great ridge running down the middle of the peninsula, which geologists designate as a terminal moraine from the third glacial period. Some deposits of the clean sand and gravel run to 8 or 10 meters in thickness, others only 3 or 4 meters. The overburden likewise varies from as little as 30 to 40 centimeters to as much as 3 to 4 meters, placing an economic limit on the deposits that can be worked profitably. Excavating throughout the district is exclusively by hand, and the only machinery used is simple screens. The sand is loaded into cars on tracks running up to the pit faces. The products are concrete gravel, plaster sand and masons' sand. One of the large producers, in its fifteen years of operation, has furnished 250,000 to 300,000 cubic meters of concrete gravel alone. The deposit at the same pit is so good that a concrete-products plant has been established, producing articles that are well known for their excellent quality. —*Tonindustrie-Zeitung* 54:789-791, June 16, 1930.

Influence of Admixtures on Fluidity of Slurry

Previous reports in published literature acquaint us with salt admixtures, which increase the fluidity of cement slurries made from lime and clay, but these salts have less or almost negligible effect on marl slurries. Dr. Karl Biehl reports in this article on the action of sulphite waste lye from the paper industry, which has proved greatest in effect on slurries from marl. The viscosity measurements were made with Kohl's viscosimeter, taken over from the ceramic industry, in which one measures the time required for 100 cc. of the slurry (or, in the ceramic industry, clay slip) to flow out. The "standard" slurry selected was one which, with the lowest possible water content, could still be conveyed with a pump without difficulty. This standard slurry showed, with 41.6 per cent water content, a period of 45 seconds for 100 cc. to flow out. This slurry was then put through the series of tests reported in the table, the results of which show a much stronger action of increasing the slurry fluidity with the sulphite lye than any other admixture, when slurry from marl is concerned. The effect of the sulphite waste lye on slurry from clay and lime has not been investigated, but the author believes that there, also, it will surpass all other admixtures in its effect.—*Tonindustrie-Zeitung* 54:396-7, Mar. 20, 1930.

	Admixture	Ascertained Water Content (*per cent*)								
		39.3	40.6	41.5	41.6	42.3	42.7	43.0	43.3	43.6
1	None	.....	Does not flow	.....	45.0	.....	.....	27.6	.....	.....
2	1% Gypsum	Does not flow	43.3	.....	34.6	.....	25.9	.....	.....	.....
3	1% Soda	do.	25.3	.....	18.5	.....	15.2	.....	.....	13.6
4	Na_2SiO_3 0.25%	.....	.....	Does not flow	.....	36.6	.....	.....	18.9	.....
5	1% Sulphite lye; spec. grav. 1.33	40.3	19.3	17.1	.....	14.0	13.6	.....	13.0	.....

Mill Temperatures and Setting Time of Cement

A previous writer in *Zement* (1929, No. 46) notes that cements which otherwise set normally are converted to quick-setting cements by high mill temperatures, and ascribes the reason for this to the fact that the high heat in the mills so far dehydrates the gypsum in the cement that it no longer is capable of retarding the setting process. The writer of the present article has often observed that a portland cement of quite normal chemical composition became quick-setting when ground in the mills of the plant although the same cement gave normal setting time when ground in the laboratory mills. To learn the cause of this there was made a long-time series of tests of mill temperatures compared with the setting time of the cement. This investigation was made in Japan where, on account of the warm climate, the clinker has little opportunity to cool in storage, and the temperature of the clinker is 60 to 80 deg. Centigrade in winter and 80 to 120 deg. in summer. The mill temperatures at the discharge end are 120 to 140 deg. and in summer 130 to 160 deg., and it is not unusual to have temperatures of 180 deg. When the temperature in the mill runs over 160 deg. Centigrade, quick-setting cements are very frequently formed, and it was observed that the quantity of the gypsum added has a close relationship to this tendency toward quick setting.

As a result of the investigations reported in this article it is concluded that, in all varieties of gypsum, a shortage in the gypsum content of the cement always makes the cement rapid-setting, that superfluous quantities of double and semi-hydrate probably shorten somewhat the time of set but do not make the cement quick-setting, and that quick-setting cements always are formed with anhydrite. After this investigation the plant concerned keeps its gypsum content down to 0.9 to 1.2 per cent of SO_3, and always avoids the formation of quick-setting cement regardless of the temperature of the mills. In the opinion of the writer, the formation of quick-setting cement in mills at high temperature is thus connected with the quantity of the gypsum rather than with changes in the gypsum's quality. —K. Koyanagi in *Zement* 19:467-469, May 15, 1930.

Use Aerial Tramways in Cement Plant in Italy

The new plant of the Fabbrica Cemento Portland Montandon at Merone, Italy, is located where it has excellent rail connections for shipping the finished product, but is separated from the quarries of limestone and marl by stretches of rough country, and the problem of the transportation of these materials to the mill was solved most advantageously by the installation of two aerial tramways. The largest line, carrying limestone, is of such size as to provide an eventual capacity of 70 tons per hour with the buckets moving at a speed of 150 meters per minute. At present the line moves at 120 meters per minute and delivers a capacity of 45 tons per hour. The length of the line, which also will be increased later, is 3,215 meters, with a difference of 31 meters of elevation between the two terminal stations. The buckets are loaded in the quarry on Decauville trucks and are picked up automatically at the loading station. The line is operated by a 20-hp. motor which has a reserve sufficient to operate the line even with increased length and increased speed.

The marl-carrying line is shorter—1,225 meters—but handles a larger present tonnage, 65 tons per hour. The marl is excavated and loaded to cars which are hauled to a loading point where the marl is stored in bins and loaded directly into the buckets of the tramway. On each tramway the track cables are 36 millimeters diameter for the loaded side and 24 millimeters for the empty side, and the pull cable has a diameter of 12 millimeters.—*Le Industrie del Cemento* (Milan) 27: 6-10, Jan., 1930.

Recent Patents

AMERICAN

Cement and Concrete

Structure for adapting oil burners to concrete-mixer apparatus. Walter C. Elze, Forest Hills, N. Y., assignor to Hauck Mfg. Co., Brooklyn, N. Y. No. 1,767,746.

Mixer for stucco compositions. Fred J. Gough, Fort Dodge, Ia., William M. McNeill, Chicago, Ill., and Frederick D. Pfeffer, Fort Dodge, Ia., assignors to United States Gypsum Co., Chicago, Ill. No. 1,767,791.

Rotary concrete mixer. Francis O'Reilly, San Francisco, Cal. No. 1,767,809.

Processes for retaining water in concrete for the hydration of cement. Claude L. McKesson, Sacramento, Cal., assignor to American Bitumuls Co., San Francisco, Cal. No. 1,768,-366.

Mixer. Michael Gilson, Port Washington, Wis., assignor to Kwik-Mix Concrete Mixer Co., same place. No. 1,768,595.

Method of making porous concrete by forcing air into cement slurries. John A. Rice, Berkeley, Cal., assignor to Bubblestone Co., Pittsburgh, Pa. No. 1,769,275.

Apparatus for producing cellular cementitious material. John A. Rice and Richard B. Rice, Berkeley, Cal. No. 1,769,310.

Mixing drum for mixing concrete, mortar, and the like. Heinrich Ruef, Zurich, Switzerland. No. 1,770,532.

Process in the manufacture of cement. Geo. A. Walter, Ithaca, N. Y. No. 1,770,958.

Crushing and Grinding

Pulverizing machinery. Walter J. Libbey, Oakland, Cal. No. 1,769,352.

Pulverizing machine. Charles M. Stoner, Chambersburg, Pa., assignor to Wolf Co., same place. No. 1,769,-867.

Pulverizing machine. William J. Armstrong, Columbus, O., assignor to Jeffrey Mfg. Co., same place. No. 1,770,382.

Hammer mill. Walter E. Van Cott, Milwaukee, Wis. No. 1,770,442.

Rock crusher. William J. Harr, Denver, Colo. No. 1,771,118.

Material Handling

Dragline fair lead. Robert L. Brown, Milwaukee, Wis., assignor to Harnischfeger Corp., same place. No. 1,767,737.

Loading apparatus. Frank Grahek, Adah, Pa. No. 1,768,316.

Excavating apparatus. Earl H. Fundom, Lima, O., assignor to Fundom Hoist & Shovel Co., same place. No. 1,769,991.

Dredge-bucket tooth. Walter B. Jenkins, Oakland City, Ind. No. 1,769,998.

Dredging machine. Edwin S. Johnson, New York, N. Y. No. 1,769,999.

Bucket-door-operating mechanism. George E. Webb, Milwaukee, Wis., assignor to Koehring Co., same place. No. 1,770,054.

Curtain cover for dumping bodies. Leroy E. Williams, Edgerton, Wis., assignor to Highway Trailer Co., same place. No. 1,770,503.

Excavating dipper. Walter E. Miley, Marion, O., assignor to Marion Steam Shovel Co., same place. No. 1,770,543.

Bucket cleaner for excavating machines. Angelo Carlesimo, Detroit, Mich. No. 1,770,837.

Clamshell bucket. Henry E. Dubkelberger and Nick Winters, Weirton, W. Va. No. 1,770,915.

Miscellaneous

Machine for forming joint reinforcements. Frederick A. Manske and William M. McNeil, Chicago, Ill., assignors to United States Gypsum Co., same place. No. 1,768,127.

Apparatus for making blocks. Frederic D. Pfeffer and Fred Trotter, Fort Dodge, Ia., assignors to United States Gypsum Co., Chicago, Ill. No. 1,768,-141.

Mining machine. Cornelius G. Boudette, Claremont, N. H., assignor to Sullivan Machinery Co., same place. No. 1,769,765.

Apparatus for disintegrating mixing, aerating, and ejecting sand or the like. George Spencer, Heywood, England. No. 1,769,806.

Mining machine. Morris P. Holmes, Claremont, N. H., assignor to Sullivan Machinery Co., same place. No. 1,769,878.

Sand-washing meter. Frank W. Herring, Detroit, Mich. No. 1,770,-308.

Mining machine. Morris P. Holmes, Claremont, N. H., assignor to Sullivan Machinery Co., same place. No. 1,770,922.

Mining machine. Morris P. Holmes, Claremont, N. H., assignor to Sullivan Machinery Co., same place. No. 1,770,923.

Mining machine. Morris P. Holmes, Claremont, N. H., assignor to Sullivan Machinery Co., same place. No. 1,770,924.

Screening

Screening plant. Hans Binte, Berlin-Spandau, and Werner Pipkorn, Berlin, Germany. No. 1,769,413.

Revolving screen and conveyor. Joseph J. Stehling, Milwaukee, Wis., assignor to Charles H. Stehling Co., same place. No. 1,769,655.

Screen. William Fowden, Rapid City, S. D., assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. No. 1,770,-977.

High-speed screen mill. Joe Crites, New York, N. Y., assignor to International Combustion Engineering Corp., same place. No. 1,771,163.

FOREIGN

Crushing and Grinding

Tube mills. Maschinenbau, Anstalt Humboldt. British 310,342.

Pulverizing machines. L. Mellersh-Jackson (Jeffrey Manufacturing Co.). British 300,802.

Pulverizers. Mme. Veuve Courtin, nee L. Lerat. French 688,923.

Apparatus for grinding ore and other materials. Hardinge Co., Inc. French 689,042.

Grinding and mixing apparatus. Joseph Emile Gernelle-Danloy. Canadian 301,571.

Spring-roller mill with pneumatic removal of the ground product. Otto August Kreutzberg. German 501,797.

Concrete

Heat and sound-proof mailable concrete and mortar. Hans Rossner. German 501,827.

Drilling

Rock drills and like apparatus. A. T. Holman and K. J. Holman. British 330,316.

Valve mechanism for rock drills. Ingersoll-Rand Co. British 330,489.

Separable rock drill. Oreste Garino. Canadian 301,570.

Hollow drill steel. Fagersta Bruks Aktie-Solaget. Canadian 301,891.

Device for rock drill. Demag Akt. Ges. German 501,583.

Apparatus for rock drill. Kommanditgesellschaft Hoffmann. German 501,597.

Percussive tool. Chicago Pneumatic Tool Co. German 501,598.

Dryers

Dryer with endless belt conveyors. Maschinenfabrik Buckau R. Wolf Akt. Ges. German 501,829.

Shaft dryer. Maschinen-und Elektrobau G. m. b. H. German 501,830.

Rotary dryer. Gustav Bojner. German 501,831.

Excavating

Excavating and loading machines. T. D. Denholm. British 330,688.

Method and apparatus for stowing the spuds of dredgers. Naamloze Vennootschap Werf Gusto Voorheen Firma A. F. Smulders. British 330,-837.

Dipper dredge or excavator. Lobnitz & Co. Ltd. Canadian 301,697.

Mechanical shovel. Frederick Archibald. Canadian 301,774.

Firing

Method and apparatus for preparing pulverulent fuel for combustion.

PIT AND QUARRY *will furnish, at its actual cost, a copy of any patent cited above. A charge of ten cents per copy is made by the U. S. Patent Office, Washington, D. C., and readers may procure a copy directly by addressing the Commissioner of Patents, with payment for copies requested. Postage stamps are not accepted by the Patent office. We will endeavor to obtain copies of foreign patents for our readers but we cannot give assurance in every case for the reason that copies of such patents are not printed for distribution as liberally as are the American copies, nor is there a fixed charge per copy.*

Peabody Engineering Corp. British 309,572.

Gypsum

Dryer for veneer wallboard. Coe Manufacturing Co. Canadian 301,-761.

Wallboard joint. David McChesney. Canadian 301,819.

Kilns

Kiln for burning lime. Emanuel Sobek. Canadian 301,606.

Grate for sintering apparatus. John Eckert Greenawalt. Canadian 301,-798 and 301,972.

Material-Handling

Conveyors. Mavor & Coulson Ltd. and J. Thomson. British 330,700.

Conveyors. C. R. Claghorn. British 317,074.

Apparatus for pneumatic conveyance of granular or powdered materials. The Pneumatic Conveyance & Extraction (1929) Ltd. (William Allen Smith.) Canadian 301,492.

Belt conveyor. Johannes Schoetzau. German 500,493.

Device for emptying bins. Maschinenfabrik Buckau R. Wolf Akt.-Ges. German 500,497.

Apparatus for automatic emptying of pulverulent or granular material from a bin by means of a screw. Societe d'Exploitation des Procedes Industriels Candlot. German 500,498.

Bunker, dumping pit or the like with discharge opening and belt for removing material. J. Pohlig Akt.-Ges. German 501,436.

Portable emptying apparatus for bins. Zeitzer Eisengiesserei und Maschinenbau Akt.-Ges. German 501,272.

Apparatus for automatic coupling and uncoupling of aerial tramway carriages. Adolf Bleichert & Co. Akt.-Ges. French 687,382.

Transport of pulverulent materials. Fuller Co. French 687,473.

Apparatus for the transport of granular materials in combination with the pneumatic separation of a part of the materials. L. A. Lesimple and E. Dupont. French 687,521.

Crane. Maschinenfabrik Augsburg Nurnberg Akt.-Ges. French 687,641.

Apparatus for continuous removal of materials, especially pulverized or crushed materials. A. Gustin. French 688,402.

Cranes. P. Perbal. French 688,664.

Material-handling devices. W. Ross. French 688,722.

Selective conveyor for various objects. R. P. A. Anderson. French 688,897.

Automatic dump car. Gust Talbot & Cie m. b. h. French 688,965.

Valve bagging and weighing machine. Rene Jarrier. Canadian 301,-576.

Worm-drive crane. Koehring Co. Canadian 301,906.

Valve-bag filling machine. Modern Valve Bag Co. German 501,570.

Sack holder. Press-, Stanz- und Hammer-Werke g. m. b. h. German 501,680.

Device for driving shaking trough conveyor. Wilhelm Schmidt. German 501,843.

Mixers.

Concrete-mixing machines. E. Muecke and Dr. V. Rajtora. British 329,713.

Concrete mixer. Koehring Co. (George Evans Webb.) Canadian 301,216.

Mixing machine. Winget Ltd. Canadian 301,291.

Automatic concrete mixing machine. Erhard Schingnitz. German 500,490.

Concrete mixer. Hauck Manufacturing Co. German 501,171.

Closing device for revolving containers, particularly for concrete mixers. Modern Concrete Development Co. German 501,172.

Foundry sand mixer. J. F. Turner. British 330,834.

Process and apparatus for storing, measuring, proportioning and mixing materials. C. B. Thorne. French 689,139.

Mixer for sand and cement. S. J. J. Canten. French 688,948.

Separating and Classifying

Material-classifying devices. H. S. Lykken. British 330,145.

Dust separators and collectors. Dorman, Long & Co. Ltd. and M. R. Kirby. British 330,163.

Apparatus for separating and classifying suspended matter from fluids. The Associated Leed Manufacturers, Ltd. (Horace Waring). Canadian 301,163.

Dust separator. Adolf Steinbrueckner. German 500,758 and 500,759.

Air separating device. Henry Moore Sutton, Walter L. Steele and Edwin Godwin Steele. German 501,039.

Device for dust separation. Valentin Schneider. German 501,040.

Separation of dry materials. B. L. Bourke and The Buckley Iron Co., Ltd. French 688,203.

Screening apparatus. A. Pays. French 688,245.

Shaking screens. E. Marot. French 688,314.

Apparatus for separating solids and liquids. Wigan Coal & Iron Co. Ltd. and A. E. Leek. French 688,485.

Means for extracting dust, grit and like solid matter from gases. O. Scott and Matthews & Yates Ltd. British 330,405.

Machine for screening pulverulent masses. Franz Schroder & Co. French 688,681.

Electromagnetic rotary separators. Soc. Industrielle de Materiel Electromagnetique. French 687,527.

Slag

Process and plant for the manufacture of poured objects, particularly paving blocks of blast furnace slag. Corwa Schlackenverwertungs Gesellschaft. French 687,287.

Treatment of blast furnace and other slags. Heinrich Buehrmann. German 501,828.

Miscellaneous

Miners' safety lamp. G. Mueller. British 318,481.

Drive chains. Morse Chain Co. British 307,018.

Clay treating device for pug mills. John Gretencourt. Canadian 301,351.

Process of obtaining oil from tar sands. Jacob Owen Absher. Canadian 301,537.

Process for production of a heat-insulating silica material. Allgemeine Elekerizitaets Gesellschaft. German 500,787.

Borax product and process of producing same. American Potash & Chemical Corp. British 330,453.

Apparatus for production of tar macadam and the like. Forth Engine & Motor Works Ltd. British 330,503.

Pit props, bars, sprags and other mine supports. J. W. McTrusty. British 330,734.

Process for treating limestones and alabasters to give them the appearance and hardness of marble. J. Giovanni. French 688,990.

Ballast cleaning machine. Frank Speno. Canadian 301,607 and 301,-608.

Sand hopper. Albert Brikman. Canadian 301,783.

Manufacture of concrete pipes by centrifugal force. Consolidated Pipe Co. Ltd. Canadian 301,979.

St. Regis Paper Acquires Bates International Bag

Acquisition by the St. Regis Paper Co. of the Bates International Bag Co., which in the last few years has licensed a large number of manufacturers to produce multiwall paper bags under Bates patents, was announced last week. The announcement said that with this new subsidiary and the Bates Valve Bag company, owned by St. Regis since February, last year, the St. Regis group is provided with coverage in a large part of the world for the development of Bates patents on multiwall bags, cement packers and bag manufacturing machinery. Thirty licensed companies, in many of which Bates International holds a stock interest, operate in several foreign countries.

Ohio Engineering Firm Effects Reorganization

The Parsons-Thompson Engineering Co., incorporated under the laws of the state of Ohio, has recently been reorganized to the extent of changing the name of the company to the Parsons Engineering Corp. with an increase of the capital stock. The direction and management of the corporation remain unchanged.

This corporation was formed by individuals for the purpose of engineering and selling the New Haven dust arrestor, flat-bag type, and controls the patents covering it. Since its entry into the field the firm has developed its product for application to the cement-plant field, where it has met with considerable success. The main office of the corporation is at 6536 Carnegie Ave., Cleveland, O., with branches in the Marquette Bldg., Chicago, and at 2700 Wight St., Detroit.

Legal Information for Operators

Sub-Contractor Entitled to Recover Payment Due

Since many dealers in non-metallic products make sub-contracts to supply labor and materials, it is important to know that generally a sub-contractor is entitled to recover payment from the principal contractor, irrespective whether the latter receives payment from the owner. So held the higher Court in Shaw v. Brennan, 22 S. W. (2d) 1092.

In this case it was disclosed that a principal contractor sublet concrete work to a sub-contractor. When the latter completed his work the principal contractor refused payment because he had not received payment from the owner. The sub-contractor filed suit against the principal contractor and it is interesting to observe that the Court held the former entitled to recover payment.

Court Defines Items in Suit on Mechanic's Lien

In Brace v. Gauges-Korsmo Co., 36 F. (2d) 661, the discussion involved whether profits and commissions are items which are subject to mechanic's liens to secure payment.

This Court said:

"Profits and commissions are not lienable items unless included in the contract price as where the contract provides for the payment of cost of or reimbursement for the amount actually paid out for labor and materials, plus a certain percentage as commissions, profits or compensations, or unless included in the reasonable worth of the labor or materials furnished as where the actual cost is less than the reasonable worth."

Cement Co. Held Liable for Pedestrian's Injury

Since considerable discussion has arisen from time to time regarding the respective rights of the drivers of motor vehicles and pedestrians, who walk on a highway, the recent case of Stotts v. Taylor, 285 Pac. 571, presents unusually interesting information.

In this case it was shown that a pedestrian was struck by a motor-truck owned by a cement company. The testimony disclosed that the pedestrian was walking with a friend on a highway 18 ft. in width. The truck driver was tooting a horn, the cut-out was open, and it was daylight. The truck was plainly visible and it was causing considerable noise. There is no doubt but that the pedestrian saw and heard the truck. However, he did not attempt to get off the highway. Therefore, the counsel for the cement company attempted to avoid liability on the contention that the pedestrian was contributorily negligent in failing to step out of the path of the truck. Notwithstanding this argument the Court held the cement company liable for $5,000 damages, stating the following established law:

"It is conceded that pedestrians and drivers of vehicles have equal rights on the highway but, of course, each must use reasonable care under existing circumstances and exercise his right with due regard to the rights of others using the highway. There may be cases where the pedestrians should step out of the traveled part of the road for his own safety but, under the evidence of plaintiff, the deceased was not obliged to leave it as the pavement was wide enough to afford room for the truck to pass without touching him. . . . If the road is so narrow that one or the other must get outside of it in order that the car may pass, doubtless this should be done by him who is on foot, because he can do it the more easily. But where the beaten track is wide enough for several vehicles to pass there can be no hard and fast rule that pedestrians must get completely outside of the highway or of the traveled portion of it."

Recovery Depends Upon Guarantee of Bondsman

In states where the statutes do not expressly require contractors to furnish bonds to guarantee payment for the purchase price of machinery, tools and the like, used in public construction work, the sellers of such equipment cannot recover payment from the bonding company unless the bond specifically guarantees payment for the cost of repairs to machinery and tools.

For illustration, in Western Material Co. v. Enke, 228 N. W. 385, it was disclosed that a seller sold to a contractor a concrete mixer and a tractor. During the construction work the seller supplied the contractor with various parts used in repairing the machine. The seller sued the contractor's surety to recover the cost of these repair parts. In holding the surety liable, the Court clearly quoted the law, as follows:

"It seems quite clear that the law . . . did not give a cause of action on the contractor's bond for the purchase price of a tool or machine sold to the contractor to be used in a public work or improvement. But it was given for the repair of a tool or machine, and for the value of the use in case the contractor rents it for the job. Where the work is of such character that the use of extensive and costly machines are required, it is reasonable to consider that the wear and tear of these machines is a necessary contribution to the work, or in other words, the reasonable value of the use of the machines contributes as much to the construction in hand as does the reasonable value of the manual labor expended thereon. . . . In a work like this, if the cement mixer should break and the contractor had in his employ a workman capable of making the repair, and who so did, no doubt such workman could resort to the bond for his payment as readily as if he sought to recover for the value of his work in mixing the concrete that actually went into the work."

Court Clearly Defines Negligence of Employer

In Scheibe v. Fruin-Colnon Co., 23 S. W. (2d) 44, the Court clearly defines negligence of an employer which entitles an injured employee to recover damages. Here it was disclosed that an employee was seriously injured as a result of a cave-in in a quarry.

The Court held the employer liable in damages to the injured employee, stating the following important law on the subject of negligence:

"In cases of negligence, the party charged may be held liable for anything which, after the injury is complete, appears to have been a natural and probable consequence of his act or omission . . . Negligence was as follows: (1) failure to brace the wall; (2) ordering plaintiff in the ditch when the earth was wet, loose, and likely to cave; (3) failure to warn plaintiff of the danger; (4) assuring plaintiff it was a safe place to work; (5) failure to brace the dirt thrown to the surface in digging; (6) failure to exercise ordinary care in inspecting the walls of the quarry."

Company Not Liable for Injuries at Recreation

The law is well established that an employee is not entitled to damages for an injury, if the injury arises outside the scope of the employment. Moreover, an employee is not entitled to damages where the testimony shows that he was injured while attending to his regular duties, if the accident did not result from negligence of the employer and was foreign to the work being performed.

For example, in Talge v. Beard, 169 N. E. 540, it was disclosed that while two employees were engaged in a playful scuffle, one of them was injured, and he sued his employer for damages. Although the lower Court allowed the injured workman compensation, the higher Court reversed the verdict, stating important law as follows:

"An injury, in order to be compensable, must not only arise in the course of the employment, but it must also arise out of the employment."

Insurance Problems Discussed

Mutual Insurance

Most people who know anything about mutual insurance are definitely either for it or against it. Like some strong personality in national politics, such as Theodore Roosevelt, whom people either revered or despised, mutual insurance seems to stir up strong feelings among both its friends and its opponents.

Now mutual insurance is a recognized part of the business world, and it is conducted by ordinary business men. Because of the violently conflicting feelings involved, it is very easy to get a prejudiced view of the subject, and because it is important to every property owner, an attempt should be made to look at the mutuals fairly and without passion.

In our last issue we pointed out that insurance is written by four different kinds of organizations, known respectively as stock companies, Lloyds, mutuals and reciprocals. While all of these organizations issue policies which look very much alike, the organizations back of the policies are quite different legally and these distinctions may make quite a difference in your insurance buying. Stock companies and Lloyds were outlined in our previous article, and mutuals and reciprocals will be treated herein.

No Stockholders

A mutual insurance company is a corporation, organized under the laws of its home state. Like any other corporation it has the merit that its rights and obligations are legally established and it can always be located legally for loss claims, suits or any other purpose. It has no stockholders. In place of a board of directors it is usually governed by trustees. In the matter of financial structure, a mutual lives primarily by its right to collect premiums from its members, the policy holders. It would seem natural for such a co-operative enterprise to levy assessments for any unusual losses, but most mutual policies place a limit (one to ten times the deposit premium commonly) to the amount which a policy holder may be assessed. The more substantial mutuals all have a large surplus over and above the premium reserves. Technically it is anomalous to have a surplus in a concern which gives "insurance at cost," because a surplus can be built up only by holding out some of the savings, and it creates a peculiar legal problem as to who owns the surplus—that is, do the former members who built it up own it, or do the present members? But from the practical standpoint the creation of a surplus is regarded as proper, and it is noteworthy that the size of the surplus frequently parallels the ability and conservatism of the management.

A mutual has no privately invested capital. Capital not only constitutes an additional reserve, but also the efficiency of the officers is likely to be greater where stockholders have their own money at risk. This double service of the capital marks the chief financial difference between the stock insurance companies and mutuals.

Inter-Insurance

The fourth class of insurer is the reciprocal, or inter-insurance exchange. A reciprocal policy holder may say, for instance, that he buys his automobile insurance from the Blank Motor Club. But if you will read his policy, you will notice that the insurance is furnished by "the Subscribers of the Inter-insurance Exchange at the Blank Motor Club." The Blank Motor Club, in this case, does not guarantee the insurance; the only connection is that the insurance exchange uses the Motor Club office as its headquarters and the club salesmen as its paid solicitors.

In its simplest form a reciprocal would be like this:

Two-Man Reciprocal

Smith and Jones own automobiles. They believe they are unusually careful drivers and therefore they are dissatisfied with the alleged high rates of the stock insurance companies. So they make an agreement to share each other's losses. As a matter of convenience each puts up a deposit of $50 to give their exchange some working funds. This money is turned over to their expert friend, Brown, who is to settle their losses and handle any lawsuits. Brown's compensation for his services is thirty per cent of the deposits.

If one of the cars is damaged by fire or strikes another car, the loss will be paid out of the deposits, and if that is not enough Smith and Jones will put up the balance through an assessment on themselves.

Suppose, however, that Smith and Jones have agreed not to have any assessments. That is they have given themselves "non-assessable" insurance agreements or policies. Insofar as fire, theft and collision losses are concerned any such limitation of assessments is perfectly valid.

But suppose Smith's automobile injures a person and Smith has a judgment for $10,000 awarded against him. Here is a third party, the innocent victim, who has rights that should be enforced. Reciprocal exponents, presumably with the backing of some state statutes, maintain that a good reciprocal policy is fully non-assessable, but in one important case a Federal judge declared that, as far as third parties are concerned, reciprocal policy holders are general partners and cannot agree to any limitation on their liability for assessments.

Without prejudicing our readers one way or the other, we may point out that some of the legal points connected with reciprocal insurance are matters of strong controversy and the subject is so important to a prospective buyer that one might well get an opinion from his own lawyer before joining an inter-insurance exchange.

A reciprocal in actual practice is merely the above case of Smith and Jones enlarged to include many hundreds of policy holders.

Study Power-of-Attorney

There is one more important difference between the reciprocal and other forms of insurance. In stock companies, Lloyds and mutuals the policy itself is the entire contract or agreement between the insurer and insured. In the case of reciprocals, however, the terms of the insurance are usually determined by three documents: the policy, the power-of-attorney which the insured gives to the motor club or other managing agency, and the by-laws of the association. In buying reciprocal insurance ask to see these other documents, because they include part of your obligations.

Differences in Rate

The insurance buyer must be perplexed by the fact that the four classes of insurance companies generally have different rates for the same risk. Some of the reasons commonly put forward to explain this difference in cost are as follows:

1—Low expenses.

2—Comparative financial weakness —"better insurance is worth more."

3—"Hard-boiled" loss adjustments. Some companies actually do save money by being tight in their claim departments.

4—"We insure only preferred risks,"—though we are frank to say that we cannot believe that any group of several thousand policy holders can be much better than average.

The true explanation of differences in rate lies in these four points. If you are uncertain as to the answer in any specific case, just try calling in a high-class competitor and get his side of the story.

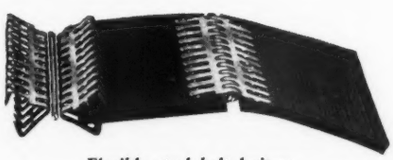
In summary, there are good and bad stock companies, Lloyds, mutuals and reciprocals. In each class you will find some organizations which have honest, capable managements and large financial reserves. The biggest thing of all, therefore, is to protect yourself against the shysters—which simply means, investigate your insurance company personally.

New Machinery and Supplies

Make Belt Lacings of Highly-Flexible Steel

Armstrong-Bray & Co., Chicago, announce a complete line of flexible-steel belt lacings having a joint composed of two segments, one rocking against the other and absorbing all wear when passing over the pulley.

This lacing is sold under the trade name of "Steelgrip" and is made of a



Flexible steel belt lacings.

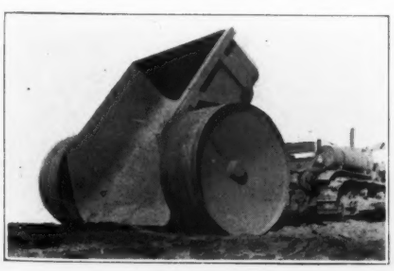
specially selected heat-treated steel embodying great tensile strength with toughness and hard enough to enable the points to be driven through the toughest belt. It is claimed that this lacing will withstand continuous use with a minimum of wear.

Adapted for use of either leather, fabric, or composition belts, it is made in sizes for belts from 3/16-in. up to any width desired.

Californian Builds New Chariot-Type Dump Cart

A new dump wagon, known as the Le Tourneau chariot-type dump cart, is said to offer an advanced step in moving material. It has been designed and perfected by R. G. Le Tourneau.

The cart is built of metal throughout, and is rugged enough to stand



Chariot-type dump cart.

rough treatment, weighing approximately seven tons when empty. It is easily dumped by means of the power-control unit operated by the tractor driver. No castings are used, it being entirely of plate steel, electrically arc-welded. The operator has a clear vision underneath the axle and can dump in a pile or can spread out his load by backing up the cart.

The axles are 6-in., heat-treated alloy steel, and extra large Timken bearings are used. The wheels are 78 in. in diameter with a 30-in. face which makes it possible to travel over soft material. Used in connection with a drag-line, it is an excellent machine where cubic yards per minute count.

The wagon is manufactured by R. G. Le Tourneau, 122 Moss Ave., Stockton, Cal.

Tractor-Powered Shovel Has Many New Features

A new tractor-powered shovel has been developed by the Detroit Power Shovel Co., Detroit, Mich., which embodies several outstanding features in this class of equipment.

In an effort to ease the work of the operator a new clutch mechanism with hydraulic control was designed, resulting in finger tip manipulation. The new clutch will greatly increase speed of operation, increasing the operator's efficiency. It will be adaptable to other types of machinery.

Another outstanding improvement is the full swinging feature. The turntable mechanism, with the boom and dipper, is full revolving, but the tractor power plant remains stationary. This arrangement increases efficiency inasmuch as the weight of the power unit is not moved with each operation.

The operating width of the new shovel is considerably less, permitting narrower cuts than the old type machine with the swinging power plant.

Steering has been greatly simplified in the new machine with the use of two hydraulically-operated clutches mounted on the rear axle shafts of the tractor. The pressure control is furnished by a small gear pump driven from the tractor fan belt. This arrangement makes it possible to drive the machine independently of the turntable mechanism.

A ⅜-cu. yd. dipper is standard equipment, with a nominal capacity of 5 dips per min. Attachments such as cranes, clamshell buckets, and trench hoes can be used. The unit is designed to accommodate any standard make of tractor power plant.

Vertical Gravity Dryer Employs Waste Gases

The Fuel Engineering, Ltd., London, England, announces a line of vertical, gravity dryers which are equally well adapted for the preheating or cooling of a large number of materials including ores, peat, chalk, bauxite, phosphate, slag, and the products of the cement mill and quarry.

This dryer has distinctly advantageous features. It handles the material in bulk and continuously without rotation or wear and tear of heavy moving parts, with the result that high production is obtained coincident with low operating cost.

The drying medium employed is waste gases which are inert so far as chemical action is concerned and which are drawn through the material at right angles by suction. The flow of material is downward by gravity and the direct, intimate contact established between the gases and material is assured with a minimum of thermal loss.

Both temperature and rate of treatment can be varied to suit conditions.

With the object of making the dryer adaptable to materials which are difficult to treat or of small size, for which it was not originally intended, new features which have been introduced

View of tractor-powered shovel in digging position.

and patented will no doubt greatly increase the value of the "F. E." Patent vertical dryer and lead to its still more extensive use, and for additional purposes. First, with the object of facilitating the passage through the dryer, of certain materials which are liable to bind, cling, or "bridge," also to reduce the resistance of fine materials to the suction of the flue gases, by increasing their porosity, the containing walls of the treating chamber are constructed to allow of slight movement in a vertical direction, the rapidity and distance of which can be varied to suit the material. This motion is effected from the shaft of the outlet valve in a very simple manner, and it can be disconnected, if and when not required. Owing to the very slight distance of movement the power required is almost negligible.

Another improved feature is the distribution and collecting screen, which is fitted in either or both the intake and exit chambers for the flue gases. The object of these screens is to make the treatment more uniform throughout the mass of material; also to obstruct and collect dust or fine material drawn away with the flue gases. Both of these objects, it will be understood, are of considerable importance.

Yet another device which has been introduced is to provide vents if the material offers excessive resistance to the passage of the flue gases through it.

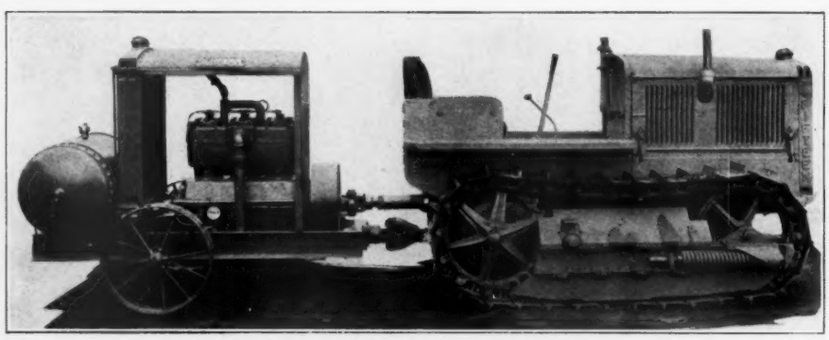
These are perhaps the most important improvements recently introduced; there have been others applying to details in design and construction. Every project should be studied individually; the nature of the material to be treated, the conditions and requirements; and the design, details, and construction of the dryer should be modified to suit.

Compressor Attachment Is Powered by Tractor

Two sizes of compressor attachments, driven from the power take-off of the Caterpillar Tractor, are announced by Schramm, Inc., West Chester, Pa.

A 120-cu. ft. displacement compressor is designed for the Caterpillar model 15 and a 240-cu. ft. compressor for the Caterpillar model 30.

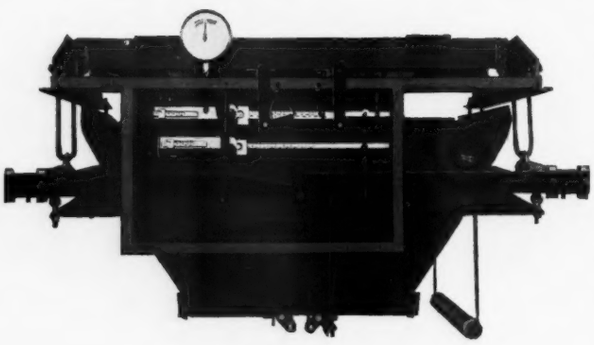
The compressor is attached to the tractor by means of a universal draw bar coupling and is driven by a power take-off shaft fitted with double universal joints and a long spline shaft coupling. This arrangement permits a flexible hookup lending itself to any road conditions without destroying the use of the tractor for other pulling or power purposes.



Air compressor driven by power from tractor.

Simplicity Is Feature of Weighing Aggremeter

A new weighing aggremeter designed to meet the specifications of the American State Highway officials and Goods Roads Associations is announced by the Erie Steel Construction Co., Erie, Pa.



Hopper for weighing aggregates.

The gates of the new aggremeter are of the clamshell type, opening by a quarter turn of the crank. Release of the crank permits the gate to close automatically.

The scale equipment is compact, with the knife edges enclosed to protect them from the material. The scale is of the charging type, leaving a beam for each compartment, and each scale is equipped with an auxiliary dial which shows the approach to the desired weight.

Another feature is the welded self-cleaning material box. Excess material can be removed from all sides of this box, with automatically closing draw-off doors fitted with a positive catch. It is impossible to open the doors without pulling a trip rope.

Simplicity has been incorporated in the design of the aggremeter. It is easy to operate and is under complete control of the operator from one position. It is built to accommodate 1-, 1½-, 2-, and 3-cu. yd. mixers.

Finned-Tube Economizer Includes New Features

A new economizer, incorporating several new features of design, has been announced by the Combustion Engineering Corp., New York, N. Y.

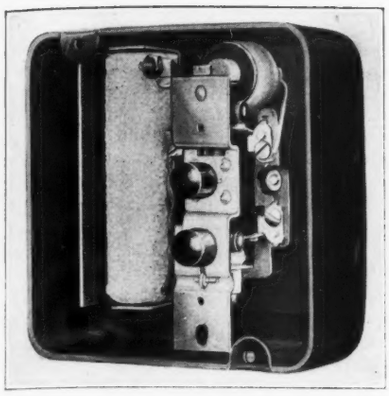
The new design makes it possible to install the C-E economizer in considerably less than half the space required for a straight, plain-tube economizer. The finned-tube arrangement permits a higher rate of heat transfer and a comparatively low draft loss, and at the same time the number of return bends is reduced to one-third of those required by a straight, plain-tube economizer. The two separate water circuits and the shorter length tubes, made possible by the use of extended surfaces, result in a water pressure drop about one-fifth that of the plain-tube single-circuit type of economizer.

Resistor-Type Starter Used for Small Motors

Cutler-Hammer, Inc., Milwaukee, Wis., announces a new resistor-type starter for fractional horsepower d. c., and single-phase a. c., motors. This new starter is designed for those applications where power company rulings require that the inrush current of small motors connected to lighting circuits, be held within definite limits and where the high inrush current incident to starting across-the-line is otherwise objectionable. On starting, a resistance is inserted in series with the motor. As the motor accelerates and the inrush current decreases, the starter automatically short-circuits the resistor, connecting the motor across-the-line. The starter is push-button operated and provides thermal overload protection to the motor.

The overload relay acts directly on the contact mechanism. Small overloads and overloads of short duration, do not trip the mechanism—the motor is disconnected only when it is in danger of burnout.

The enclosing case for this new



New resistor starter.

starter is a standard double wiring box which can easily be mounted on the machine, on the wall, or at any other point convenient to the operator. Starters can also be obtained without the enclosing case for building into the pedestal or other part of a machine.

Maximum horsepower ratings are ¼ hp., 115 volts, d. c., and ¾ hp., 110 or 220 volts, a. c.

Centrifugal Lubricator For Use on Roller Mill

A new centrifugal lubricator has been developed by the Texas Co., New York, N. Y., for use with Raymond roller mills.

It is designed to give economical lubrication with oil in place of grease which was formerly used. The exact amount of oil required for efficient lubrication is measured by a metering tube which is supplied by oil through centrifugal force from the rotation of the rolls.

Some of the advantages claimed for the new lubricator are: lower costs of both power consumption and lubricants; increased operating hours between shut-downs for renewal of lubricant; reduction of time required for oiling; and elimination of product contamination.

Robins Conveying Belt to Manufacture Chutes

The Robins Conveying Belt Co. has been granted, by the Adams Coal Machinery Co., of Plainfield, N. J., the right to manufacture and sell the Adams avalanche chute, the Adams withdrawal chute, and the Adams floating chute to the different industries and operations where bulk materials such as stone, sand and gravel are handled.

The Adams avalanche chute is the unit which moves material into a bin or silo in a series of masses. No rolling or tumbling of individual pieces takes place. There is no breakage and no segregation of sizes as is commonly observed in bins filled without these chutes. Spillage over the sides of the chute never occurs. The material is eased rather than dropped into the pocket. The chute is gradually buried in the rising pile and the capacity of the bin is not reduced in any way.

The Adams withdrawal chute is the unit which unloads a pocket from the top rather than the bottom thus maintaining a uniform mixture of all sizes. All the movement is on the surface, laterally toward the discharge column. Side pressure on the discharge column with its resultant grinding and rubbing action is eliminated as the material under the surface remains in place. The material in the withdrawal chute does not pack.

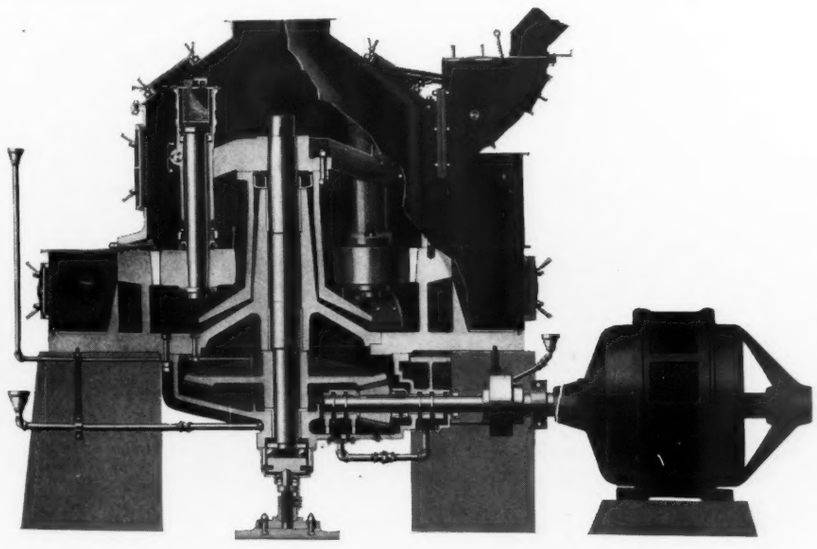
The Adams floating chute is the unit which loads trucks or cars from the bottom up without any dropping of the pieces. The chute with its bottom gate closed is gradually filled from the bin while the chute is being lowered so that there is no dropping of the material in the chute. The bottom gate is then opened against the bottom of the truck and as the pile rises, the chute is raised.

Three-position pilot switch.

Pilot Switch for Pumps and Similar Machinery

A new three-position pilot switch permitting either automatic, manual, or "off" control for pumps, compressors, and similar machinery is announced by Cutler-Hammer, Inc., Milwaukee, Wis.

This type of machinery frequently requires manual control, which was formerly impossible to obtain in the usual type of float switch or pressure switch. When the operating lever of the new switch is placed in manual position the circuit is closed and the motor will run continuously regardless of any other control device. When placed on the automatic position the automatic pilot device is in circuit and normal automatic operation is obtained. The lever will remain in any one of the three positions.



Centrifugal lubricator for roller mills.

Traveling Water Screen Has Overlapped Trays

A traveling water screen with a new design of tray and basket construction, resulting in a 10 per cent greater depth of screening area, is announced by the Link-Belt Co., Chicago, Ill.

The trays are now overlapped with seal plates between the ends of the trays and the elevating chains. The space between trays in the guides and the boots is reduced to a minimum, preventing the passage of trash.

The drive consists of a moisture-proof motor, herringbone gear, fully-housed speed reducer running in oil, equipped with anti-friction bearings, and a guarded steel roller-chain drive to the screen headshaft.

Screen trays can be cleaned automatically by sprays of water either on the ascending or descending run.

Manufacturers' Publications

Each publication listed below contains information of interest to nonmetallic mineral producers. Readers may obtain, without charge—except where a price may be stated—and without obligation, copies of any of these publications by writing directly to the manufacturers who publish them. Please mention PIT AND QUARRY *when writing.*

Cement

"The Economy of Modernization." 2 p., 4 ill. (*Monolith Mixer* for third quarter, 1930. Monolith Portland Cement Co., Los Angeles, Cal.) Discusses the value of modernizing old buildings by the use of cement.

Crushers

Cedar Rapids Crushers. 56 p., illustrated. (Catalogue. Iowa Mfg. Co., Cedar Rapids, Ia.) Describes and illustrates a full line of pit and quarry crushers, bin equipment, and steel gravel-plant assemblies.

Economizers

C-E Economizer. Catalogue EC-1. 12 p., ill. (Combustion Engineering Corp., 200 Madison Ave., New York, N. Y.) A well-illustrated description of the new fin-tube economizer with complete construction details.

Excavators

Haiss Excavators. 20 p., illustrated. (Bulletin No. 530. Geo. Haiss Mfg. Co., Inc., New York, N. Y.) Describes and illustrates a line of excavators which will dig and load earth, clay or natural soil for grading, stripping overburden, light excavation, and stockpile loading.

Explosives

"Buying Earthquakes." 2 p., 6 ill. (*Du Pont Magazine* for July, 1930. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.) Describes and illustrates the new science of producing artificial earthquakes in geophysical prospecting in oil fields.

Limestone

"Limestone and Its Uses." 3 p., 2 ill. (*Calcite Screenings* July, 1930. Michigan Limestone & Cement Co., Rogers City, Mich.) Review of calcium carbide manufacture and its present uses with its relation to limestone.

Mine Cars

History No. 5. 4 p., 3 ill. (Sanford-Day Iron Works, Inc., Knoxville, Tenn.) Descriptive bulletin showing operating savings in the use of S & D "Double Automatic" drop bottom car.

Motors

"General Purpose Synchronous Motors." Bulletin GEA 708A, 4 p.; GEA 1052A, 4 p. (General Electric Co., Schenectady, N. Y.) Revised bulletins on synchronous motors with illustrations showing construction of the "7500" Series and "7600" Series motors.

Bulletin GEA 754A. *Semi-Automatic Reduced Voltage Starters* for synchronous motors.

Bulletin GEA 579A. 2 p., ill. *Automatic Full Voltage.*

Controllers. 2 p., ill. Revised descriptive bulletin of control apparatus for synchronous motors operating pumps, compressors, and general purpose duty.

Power Plants—Electric

Electricity, for Every Need. 25 p., ill. First edition. (Kohler Co., Kohler, Wis.) A new illustrated bulletin of Kohler electric plants and their adaptability in various fields. Complete with specification tables.

Safety Equipment

Bullard—Everything in Safety. 143 p., ill. (Catalogue. E. D. Bullard Co., San Francisco, Cal.) A new catalogue of everything required by the safety engineer and plant superintendent for the protection of the worker from absorbent cotton to welding goggles.

Shovels

"Thew Lorain." 4 p., 24 ill. (*Center Drive* for July and August, 1930. Thew Shovel Co., Lorain, O.) Pictorial news magazine illustrating uses of Thew Lorain equipment.

Tractors

Caterpillar Magazine. 20 p., ill. (No. 51 for July, 1930. Caterpillar Tractor Co., San Leandro, Cal.) Photographic views and descriptive notes on the numerous uses of Caterpillar tractors in various fields.

Welding

Atomic Hydrogen and Welding Equipment. Bulletin GEA 823C, 4 p. (General Electric Co., Schenectady, N. Y.) A revised bulletin describing the atomic hydrogen method of welding, the equipment, control apparatus, and operating data.

New Corporations

Missouri Rock Asphalt Co., 2814 Prospect Ave., Kansas City, Mo. William Hicks. $50,000.

Marus Stone & Marble Co., Chattanooga, Tenn. $30,000.

Walter B. Lippincott, Inc., Woodstown, N. J. Walter B. Lippincott, Edwin A. Lippincott. $125,000.

Central Rock & Sand Co., Kingsport, Tenn. C. E. Brooks, vice-president; W. R. Jennings, secretary-treasurer; R. M. Blanchard, assistant secretary-treasurer. 1,000 shares n.p.v.

Little Rock Stone Products Co., Box 863, Little Rock, Ark. Dwight S. McVicker, president; V. C. Johnson, vice-president; J. C. Baker, secretary. To produce trap rock, riprap, crushed stone, ballast and chat. 500 shares n.p.v.

West Nyack Trap Rock Co., Inc., West Nyack, N. Y. William Dahm, president. 200 shares com.

Somerset Trap Rock Co., Somerset St., North Plainfield, N. J. Charles S. Lewis, president; Frank E. Weldon, secretary; William H. Weldon, treasurer.

National Quarry & Stone Co., Buncombe, Ill. Calvin Mathis, Edward H. Reuter, Robert A. Kean. $20,000.

East Hempstead Sand & Gravel Corp., care W. Godnick, 16 Court St., New York, N. Y. 200 shares com.

Riverside Sand, Gravel & Crushed Stone Co., 800 Tyler Ave., Amarillo, Texas. William L. Slayden. $50,000.

City Sand & Gravel Corp., 551 Fifth Ave., New York, N. Y. J. A. Byrne. 1000 shares com.

Virginia Glass Sand Corp., Winchester, Va. Walter R. Talbot, president. To mine glass sand. $150,000.

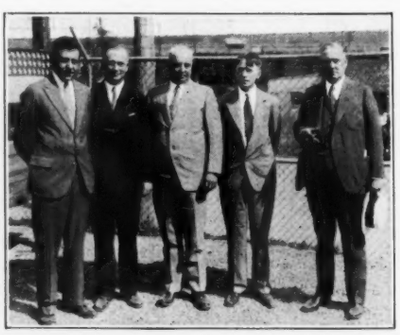
Cutler-Hammer Acquires Bakelite Products Firm

Effective Aug. 1, the Reynolite Division of the Reynolds Spring Co., Jackson, Mich., became the wholly-owned subsidiary of Cutler-Hammer, Inc. This transaction brought into the constantly growing Cutler-Hammer line, the well-known and widely sold Reynolite products—bakelite flush plates and plural plugs. The Reynolite name marked the first flush plates molded of bakelite and today marks the most complete line of such plates in the world.

E. D. Bullard Co. Opens New Offices in Chicago

E. D. Bullard Co., manufacturers of the Hard Boiled Hat and distributors of the U. C. C. combustible gas indicator and methane detector, announces the establishment of a Chicago office at 224-230 W. Huron Street, Chicago, Ill. The office is in charge of G. M. Glidden, who has for many years been identified with the safety movement in the East and Middle West. This is the sixth office of E. D. Bullard Co. and the second to be opened within the past year.

Dedicate Trophy



Here are some of the men who participated in the recent dedication of a Portland Cement Assn. safety trophy at the York plant of the Medusa Portland Cement Co. Left to right: W. L. White, Jr., general supt.; A. J. R. Curtis, Portland Cement Assn.; E. J. Maguire, vice-president and treasurer; R. J. Landis, supt. of York plant; J. B. John, president, and chairman of P.C.A. committee on accident prevention.

Suggested Topics for Discussion at the September Safety Meeting

FOR your September safety meeting two special topics are suggested. The first of these is "Remarks by your chief engineer or master mechanic." The second topic, on "Ladders," might not seem so important but it is closely related to falls, which cause more accidents, in our working places and in our homes, than any other one thing.

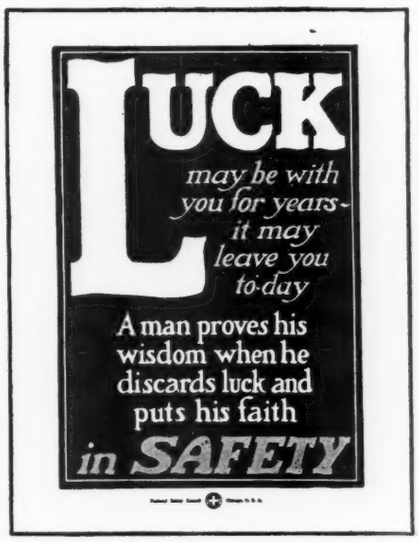
The chairman of your safety committee, of course, should make arrangements well ahead of time for the chief engineer or the master mechanic of your plant to give his address before your September meeting. Your chief engineer doubtless will realize that there is a close relationship between his work and the safety problems of the plant. But, even so, he may need some preliminary instruction or warming up. He should be made to realize that lack of engineering safeguards and precautions have caused many thousands of industrial injuries and accidental deaths.

It was quite natural, of course, when engineers did their original work in the designing and the construction of our railroads, automobiles, and industrial machinery that they should give their thought chiefly to the problems of mechanical operation without much regard for the human hazard. As the engineering features have become more perfected, greater attention naturally has been given to effective operation. Therefore, it is logical that the general public, including the managers of industrial plants and the workers in these plants, should expect these engineers gradually to adopt additional engineering features toward lessening the great economic losses through industrial accidents.

It is probable, however, that your chief engineer, through his professional interest in his own work and through his association with your plant safety engineer, will fully realize the close relationship which has always existed between engineering developments and safety achievements. In fact, your chief engineer may be so full of this subject and so interested in the opportunity to point out this relationship in detail, from examples in your own plant equipment and operations, that it may be necessary to limit his time.

The speaker might be asked to discuss briefly one or more of the following topics:

1. The engineer's place in the safety movement.
2. What the engineer has done for the safety of the human race.
3. What our engineering department (or our master mechanic's department) has done to prevent accidents in this plant.
4. Safety and plant production go hand in hand.
5. Guards in their proper places do not cause a decreased production.
6. How our plant safety committee can assist the engineering department (or the master mechanic's department) in preventing plant accidents.


LUCK
may be with you for years - it may leave you to-day
A man proves his wisdom when he discards luck and puts his faith in SAFETY

The chief engineer or master mechanic, when he has finished his talk, may be invited by the chairman to take a leading part in the discussion of the second topic of the meeting, on "Ladders."

Ladders are used so frequently and for so many different jobs in the quarry industry, that it is not surprising that ladders each year directly or indirectly cause the injury of many workers. Likewise, ladders cause many injuries in our homes; and the same principles that apply to the lessening of accidents from ladders in quarry operation also apply to safety precautions with ladders in our homes.

Previous to the meeting one or more sub-committees should be appointed to make a survey of all the ladders which are used in every department of your plant, and to report on the condition of these ladders. To give the greatest value to these reports, a detailed list of suggestions should be prepared for the guidance of the committee or committees. Following are some of the questions which might be considered:

1. Are there any places in the plant where fixed ladders should replace portable ladders?
2. Is there sufficient clearance back of each fixed ladder so that the worker may get a firm foothold on each rung?
3. Are there any obstructions in front of any fixed ladder against which a worker might bump his head?
4. Are the fixed ladders in the plant in good condition and comparatively free from rust (or from decay if they are wood ladders)?
5. If a fixed ladder is used to get onto an elevated level, are the ladder side-rails extended beyond the elevated level to help the worker when leaving or mounting the top of the ladder?
6. Are the portable ladders of the plant in good condition?
7. Make sure that paint does not hide ladder defects.
8. Are all rungs on all ladders equally safe?
9. Do all portable ladders have non-slip bases in good condition?
10. When necessary, do the ladders in this plant have hooked tops?
11. Is the spreader on each step-ladder in good condition?

The safety committee, as a climax to this meeting, should recommend that all unsafe ladders in the plant be either destroyed or repaired. Based on the reports and the discussion before the meeting, this recommendation should include a definite list of the ladders of the plant which are considered unsafe; and an additional list of ladders which should be repaired, possibly with detailed recommendations as to these repairs.

Interest in the problem of safety with ladders might be heightened by the display, at the time of the meeting, of special safety posters.

Protective Headgear Is Good Accident Insurance

Protective headgear is not new but, like all things, comes into its own in new fields from time to time as the exigencies of the situation demand. During the Middle Ages various forms of steel helmets were used and were finally discontinued as the use of gunpowder became current. The steel helmet was no longer proof against the penetration of projectiles, but later, during the great war, helmets were again universally employed to guard against wounds resulting from shrapnel and steel slivers from bursting shells. Although the helmet was not proof against steel-jacketed bullets it did turn stones, gravel, and splinters.

A species of metallic protective cap designed for the underground worker, which will prevent injury to the head, has been tried successfully by the Phelps-Dodge Corp., Dawson, N. M., over a period of years. The head equipped with this cap can sustain without injury a blow of sufficient force to bend the worker's legs. The cap is flame-proof, waterproof, and insulated against electrical shock. The results obtained in accident prevention by the Phelps-Dodge Corp. are shown by the following statistics:

	1924	1926	1928
Number of scalp injuries	62	35	4
Number of days lost time	6,532	199	27

The figures are conclusive. No comment is necessary except that, if workmen are exposed to injury due to falling rock or other material, they should be afforded the opportunity to protect their heads as well as their feet, the latter being already guarded by hard-top shoes.

Observing Simple Maintenance Points Makes Chain Drives Last Longer

By CHAS. R. WEISS
Chief Engineer, Link-Belt Co.

I was recently asked, "How can I make my chain drives last longer?" and after considering the question, I answered this maintenance man as follows:

To make your chain drives last longer, there are just five simple things for you to do. Note the sketches I have drawn for illustrating each point.

First—proper alignment. Be sure that sprocket wheels are in line on the shafts, as shown in Fig. 1. If the

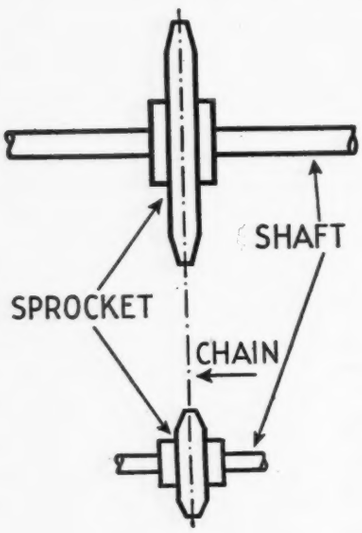


Fig. 1—Proper alignment.

sprockets are not exactly in line, a side pull develops which concentrates the load on the side of the sprocket teeth, and on one side of the chain. This faulty alignment results in excessive wear on both chains and sprockets.

Second—proper adjustment. The chain should be run just a little slacker than a belt—about as shown in Fig. 2. Too much tension causes undue wear on the chain, and wasteful friction on the bearings. Not enough tension, of course, may allow the chain to jump the sprockets, or ride the teeth and break.

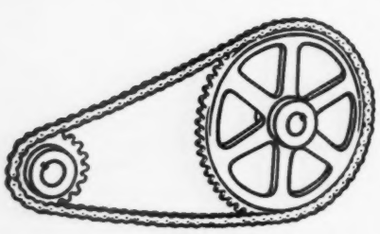


Fig. 2—Proper adjustment.

Third — frequent lubrication. The chains should be lubricated at frequent intervals. A good grade of light cylinder oil should be used. A paint brush is a good thing for applying oil to the chain joints, as I have indicated in

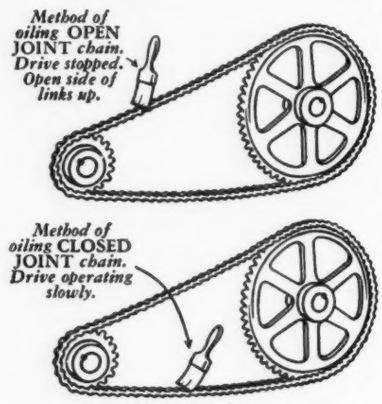

Method of oiling OPEN JOINT chain. Drive stopped. Open side of links up.
Method of oiling CLOSED JOINT chain. Drive operating slowly.

Fig. 3—Frequent lubrication.

Fig. 3. Paint the open joints on open (upper) side. Oil the closed joint chains on inside (upper side of lower run) while drive is running slowly.

Fourth — frequent cleaning. Open drives should be cleaned regularly. Take the chain off, and clean it well by soaking and dipping in kerosene, see Fig. 4. Dry well, and oil it thoroughly before starting up again. Before shutting down a machine for a period of time, clean the chain, and oil it with heavier oil or grease. When it is to be used again, re-clean and oil with light oil.

Fifth—well-fitting sprockets. Last, but not least, look at the sprocket wheels from time to time to make sure

Fig. 4—Frequent cleaning.

that they are not worn enough to injure the chain. Before the teeth are worn to a hook shape, as shown in lower illustration of Fig. 5, the wheels should be replaced with accurately

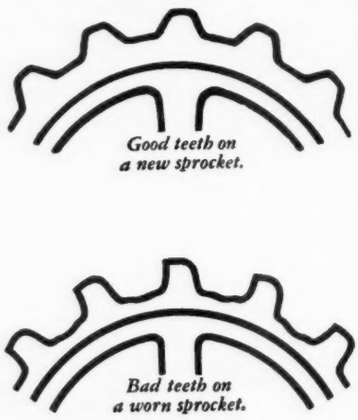


Fig. 5—Well-fitting sprockets.

made and close-fitting sprocket wheels.

By giving only ordinary attention to your chain drives you make them last longer and run better, and also reduce the chances of a breakdown.

If these recommendations are followed I am sure you will be time and money ahead and will get the best wear and service out of your machinery.

American Machine Buys Manhattan Electric Co.

Announcement is made that American Machine & Metals, Inc., has succeeded to the business of Manhattan Electrical Supply Co. Inc., and that C. K. Woodbridge of Prince & Whitely, formerly president of the Dictaphone Corp. and of the Kelvinator Corp., succeeds Richard H. Brown as president of American Machine and Metals, Inc.

The officers and board of directors of the American Machine and Metals, Inc., will continue to operate the subsidiary companies in cooperation with the operating executives, and contemplate such improvement and extension of the several businesses as will, in their opinion, make for better products and service.

One of the subsidiaries of American Machine & Metals, Inc., is the U. S. Manganese Corp. which operates a stone quarry at Waynesboro, Virginia.

Organize Iowa Firm to Sell Plant Equipment

The A. H. Puffer Co., Cedar Rapids, Ia., has been organized to handle a complete line of crushers, gravel plants, washing plants, pre-mix plants, road-mix machines, accessories and supplies. Mr. Puffer, who heads the concern, was formerly with the Standard Road Equipment Co. of Rockford, Ill.

Use of "Wooden" Powder Declared Poor Practice

In some mines the use of so-called "wooden" powder in blasting is in vogue. At one property the practice is confined to raises. In loading his holes, the miner uses alternate sticks of powder and wood, the latter being of the same dimensions as the powder. The purpose is to secure economy in the use of powder.

This practice is not common, however, and is not considered good by explosives companies, says Arthur LaMotte, manager of the Du Pont company's technical section. The reason is that the detonating wave seldom carries with full effect through the wooden spacers, and consequently bad fumes—in some cases, poisonous fumes—are more likely to be generated than where only dynamite is loaded. A much better effect would be obtained by using cartridges of dynamite of smaller diameter and placing them end to end in the hole when an air-cushioning effect is desired. With the large variety of explosives, having widely different physical characteristics, that is now available, it is usually possible to select one which will give the effect desired, even when the borehole is entirely filled.

Canada Cement Co., Ltd., Has Impressive Future

Although sales of Canada Cement Co., Ltd., thus far this year have been somewhat below 1929, earnings of the company for the full fiscal year, ending November 30, next, are not likely to be far from the unusually high level of last year.

For the twelve months ended November 30, 1929, the company reported net income of $1,600,701, after depreciation, interest and reserves, equivalent after 6½ per cent preferred dividend requirements to 38 cents a share on 600,000 shares of no-par common stock. This compared with net income of $1,396,951, or 5 cents a common share in 1928.

The company is just entering its busy season, as a large bulk of its shipments is made during the summer months. Shipments during the winter months usually represent scarcely 10 per cent of the year's total, although this percentage is showing an upward trend as winter construction work increases.

This year continued demand for cement for the huge hydro-electric projects under construction in the Dominion is keeping up sales to a high level, in the face of falling off in some lines of building due to the general business depression. Important orders have been received for such projects as the new Abitibi Power and Paper hydro development in northern Ontario, the Beauharnais development on the St. Lawrence River and similar undertakings.

In addition, certain Canadian provinces are building cement roads this year to attract the increasingly important tourist business.

Canada Cement's export business continues to be handicapped by lower labor costs and lower ocean freight rates of European competitors. Improvement of distribution facilities in eastern Canada, however, probably will stimulate shipments abroad. Recently, storage bins and packing plants were completed in Halifax and Quebec, and this summer similar facilities will become available at St. John. A new 3,500-ton vessel supplies these distributing plants with cement and brings back from Nova Scotia gypsum used at the producing plants.

The company during the last year and a half has been remodeling its various plants to increase efficiency. By the end of the year the Longue Pointe plant, at Montreal East, will have been converted to a wet-process mill. The Hull, Exshaw, Winnipeg and Port Colbourne plants already have been remodeled.

Canada Cement handles approximately four-fifths of the total Canadian cement business, operating twelve plants in four provinces, with a total productive capacity of 12,000,000 barrels per year.

Refractories Handbook Published by Institute

The eighth edition of *Brands of Refractories* has just been issued by the American Refractories Institute. This booklet lists every known manufacturer of fire brick in the United States and Canada, together with a list of the brand names of their products.

Copies may be obtained from the secretary's office, Oliver Bldg., Pittsburgh, at a cost of 25 cents each.

Mechanical Engineers' Handbook Is Issued

Engineers' handbooks, or *formulaires*, as they are sometimes called, are ordinarily considered dry reading and possessed of no great interest except when required to unravel some knotty problem; but, whatever truth there may be in such an assertion, it would be lack of judgment so to characterize the *Mechanical Engineers' Handbook*, which has recently left the press of the McGraw-Hill Book Co., New York, N. Y.

Possessed of the latest information on the varied subjects, the editor-in-chief, Lionel S. Marks, professor of mechanical engineering at Harvard University, and staff have produced a work calculated, from the standpoint of the engineer, to fulfill every requirement.

The first printing of this, the third edition, took place in June, 1930. In order to keep pace with the rapid developments of the last few years, much new material has been added and every subject has, in fact, been rewritten and enlarged. An inspection of the second edition shows that some 250 pages have been added, covering the added material and changes necessary to bring this work up to date. New subjects have been added and 77 contributors are noted, each a specialist in his line.

The formidable amount of material covered by a work of this nature can only be appreciated by a careful inspection and comparison with, for example, the list of references given. It will easily be seen that the accumulation of material for a handbook of this nature requires rather more than the average person's conception of editorial capability. The price of the volume is $7 net, postpaid.

Georgia Granite Co. to Construct New Building

The Georgia Granite Co., Elberton, Ga., has awarded contracts for a new stone shed to be one-story, 340 ft. by 55 ft., with steel frame and sheet metal walls. The Converse Bridge & Iron Co., Chattanooga, Tenn., will furnish structural steel. C. Comolli is president of the Georgia Granite Co.

Sell Crystalite Stone Products to Canadians

The Crystalite Stone Products, Ltd., of Hamilton, Ont., Canada, has been acquired by Gypsum, Lime & Alabastine, Canada, Ltd., it is announced by J. F. Cameron, general sales manager. It now operates as a division of the Gypsum Co. under the name of Crystalite Products, Ltd.

A few weeks ago the president of the company, R. E. Haire, sailed for England to study the possibilities of adding a plant in Britain.

Construct Barite Mill at Barstow, California

A 100-ton mill for the flotation treatment of tailing containing barite has been constructed at Barstow, Cal., by B. S. Hook and C. Shapley, it is reported. Tailing from the old Waterman mine, near Barstow, will be handled and the product shipped to Los Angeles.

Memphis Producer Has Agency for Smiley Co.

The Wolf River Sand & Gravel Co., of Memphis, Tenn., has acquired the sales agency for western Tennessee of the Smiley Sand & Gravel Co. of Perryville, Tenn. The Wolf River concern also represents the Anna Stone Co. of Anna, Ill., producers of crushed limestone and agstone, in Tennessee.

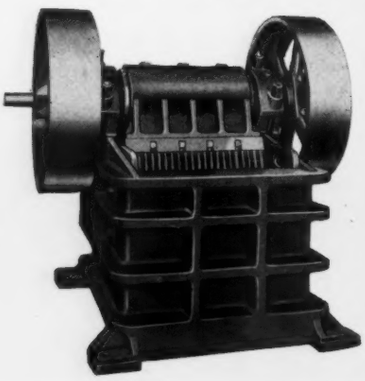
Does Your Crusher

run a full season without a shut-down? No? Then you should know about *one* of the new construction details in the Wheeling Roller Bearing Crusher which absolutely guarantees long life and continuous crusher service.

A DUST GUARD THAT WORKS

Pictured above is a Dust Guard, which permits lubrication of the toggle joint, completely excluding all dirt, dust, grit, etc. Result is the greatly increased life of the toggle joint, which should allow a full season's run without shut-down. A dry toggle joint usually requires attention about every two weeks, and lubrication without dust and dirt protection is hopeless. The Wheeling Dust Guard has solved the problem of uninterrupted crusher operation, simply and effectively.

May We Tell You More?



Wheeling Mold & Foundry

Division of

Continental Roll & Steel Foundry Co.

Wheeling, West Virginia

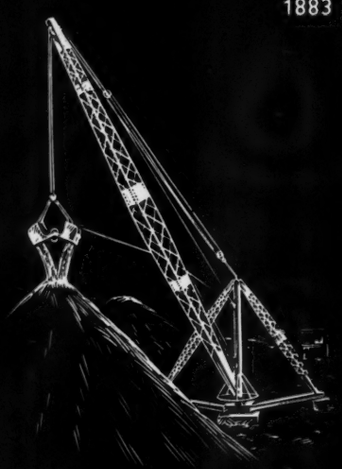
AMERICAN

Steel

Stiffleg

Derricks

Leaders Since 1883



Quality Engineering

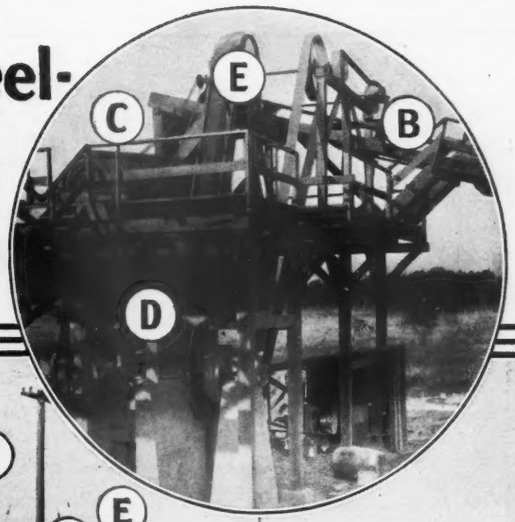
AMERICAN

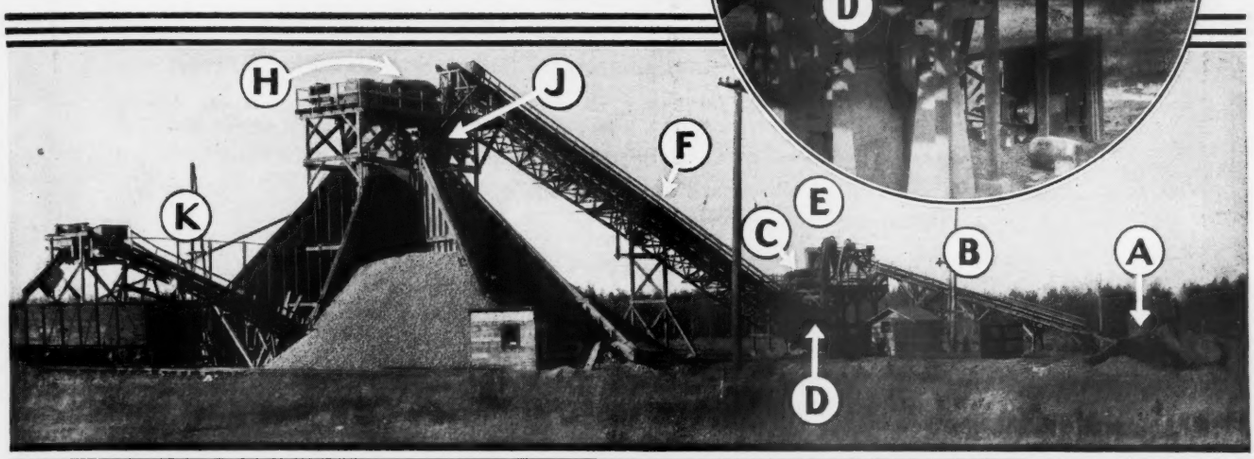
HOIST & DERRICK CO.

Saint Paul, Minnesota

AMERICAN GOPHER SHOVEL-CRANE

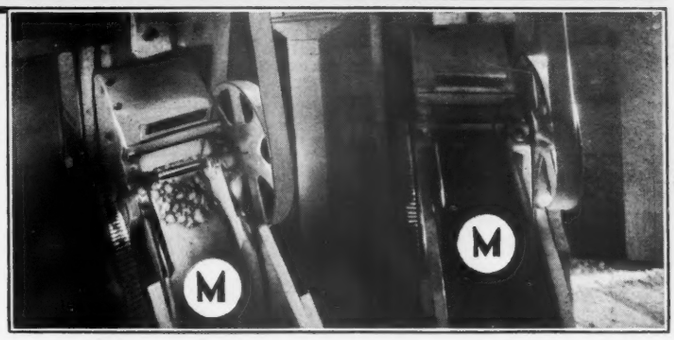
BUILT like a wagon wheel—a NEW and PROFITABLE IDEA in Gravel Production



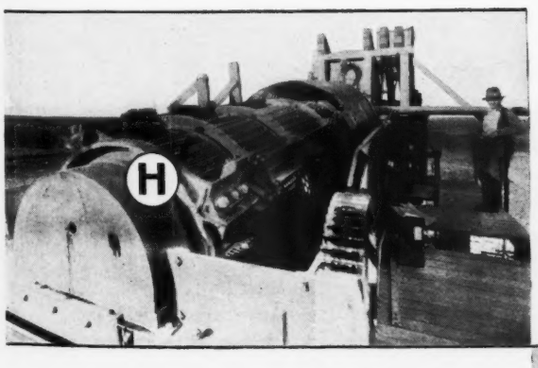


The Champion Gravel Co. had ten years' experience . . . and three other gravel plants. There were market, production and storage problems to be solved in building their new Beechwood, Mich., plant. Telsmith solved them *practically* and *profitably*.

In this unique plant, eight sizes of material are distributed outside of the 35 ft. octagonal tower, between partitions that radiate from it like wheel spokes. Inside the tower, a series of Telsmith rotary feeder bin gates (M) discharge into a common hopper which in turn discharges to a belt conveyor from which cars or trucks are loaded. This system permits material to be proportioned exactly as desired. Enormous storage capacity is provided at small expense; surplus is easily removed to reserve ground storage; material does not disintegrate; production and shipping are separate and independent. This is the Kern Tower System of stock piling on which a patent is pending.



High production efficiency is maintained by properly coordinated all-Telsmith equipment, which includes, in flow sheet order: 20 in. Telsmith Plate Feeder (A); 24 in. x 109 ft. Telsmith Belt Conveyor (B); 40 in. x 10 ft. Telsmith Scalping Screen (C); No. 8-A Telsmith Primary Breaker (D); 24 ft. No. 4 Telsmith Bucket Elevator (E); 20 in. x 137 ft. Telsmith Belt Conveyor (F); 40 in. x 17 ft. Telsmith-Hercules Washing Screen (H); No. 7 Telsmith Sand Tank (J); 20 in. x 72 ft. Telsmith Belt Conveyor (K).



Telsmith not only designs and builds gravel plants from crushers to bin gates but guarantees results. Get Bulletin GP-15 describing this complete service.

See P&Q HAND BOOK Pages 176-248

SMITH ENGINEERING WORKS

88 Capitol Drive, Milwaukee, Wis.

C-8

TELSMITH

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